ORDER NO. MTNC010303C1
B1

Service Manual

Color Television

Main Manual

(NA7D)

Panasonic

Models	Chassis
CT-20R6E	**AP359**
CT-20R6CE	**AP359**
CT-20D11E	**EP360**
CT-20D11DE	**EP360**
CT-2006SE	**FP360**
CT-20G6E	**DP359**
CT-20G6DE	**DP359**
CT-2016SE	**FP360**

This Service manual is issued as a service guide for the models of the **NA7D** family listed above. Included in this manual are a set of schematics, block diagrams, functional descriptions, alignment procedures, disassembly procedures, and a complete parts list.

"**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this Main Manual.

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Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety Precautions

General Guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always Replace Protective Devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc.

High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **Handling the Picture Tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits the X-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **35kV** without causing X-ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc.

If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage Current Hot Check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 1/2 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

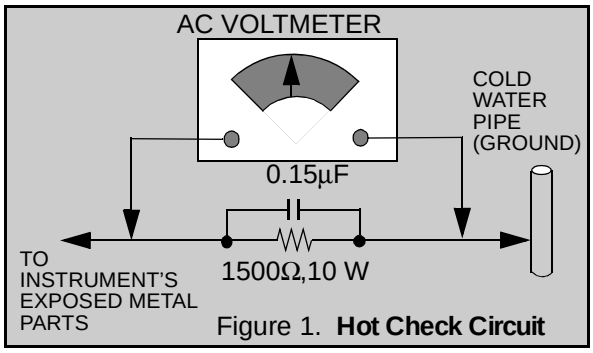

Figure 1. **Hot Check Circuit**

X-ray Radiation

WARNING: The potential source of X-ray radiation in the TV set are the High Voltage section and the picture tube. Refer to **X-RAY PROTECTON CIRCUIT CHECK** in Service Notes in this manual to confirm HHS Voltage.

High Voltage (CRT Anode)

Confirm Anode voltage is within limits:

Set the BRIGHTNESS, PICTURE, SHARPNESS and COLOR to minimum (To obtain a dark image). Measure High Voltage. It should be:

26.60±1.25kV for CT-20R6E/CE, CT-20G6E/DE, and 27.70±1.25kV for CT-2016SE, CT-2006SE, CT-20D11E/DE.

If the upper limit is out of tolerance, immediate service and correction is required.

Note: *It is important to use an accurate, calibrated high voltage meter.*

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Service Notes

Note: *These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.*

Leadless Chip Component (surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

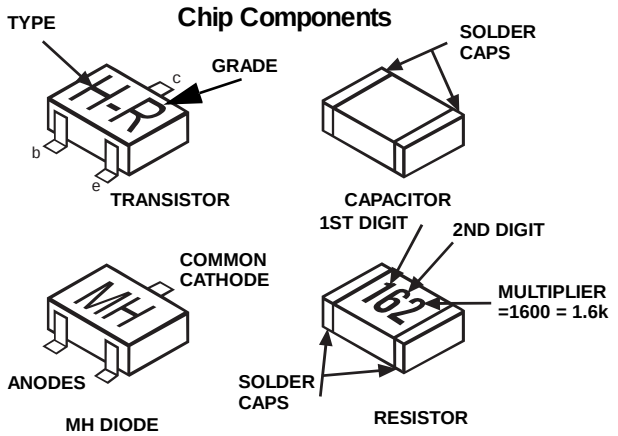
Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

Component Removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip Component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

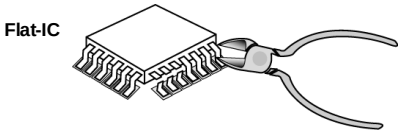


How to Replace Flat-IC

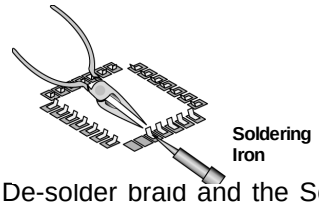
- Required Tools -

- Soldering iron
- De-solder braids
- Sharp pliers (wire cutter and long nose)
- Magnifier

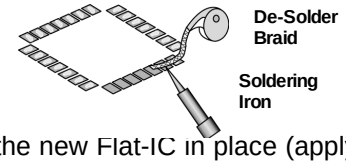
1. Cut the pins of the defective IC with the wire cutters pliers, and remove it completely away from the board. If the IC is glued to the board, apply hot air to complete the removal. **CAUTION**- Do not pull or twist the pliers, it may damage the soldering pads in the board.



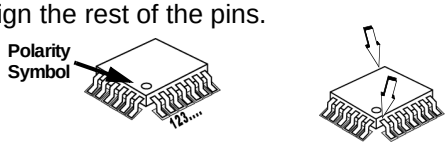
2. Using the Soldering Iron and the long nose pliers, remove the IC pins that still attached to the board.



3. Using the De-solder braid and the Soldering Iron, remove the solder from the board soldering pads.

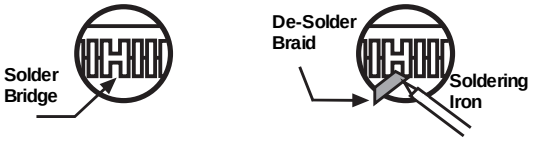


4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Properly determine the positions of the soldering pads and pins by correctly aligning the polarity symbol. Start aligning and soldering Pin No.1, then align and solder the pin in the apposite corner of the IC, this will help to align the rest of the pins.



5. Solder all pins to the soldering pads using a fine tipped soldering iron.

6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.



Service Notes (Continued)

IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CTR DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground ⏚ () or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X-ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.

X-RAY PROTECTION CIRCUIT CHECK

This test must be performed as final check before the Receiver is returned to the customer. If Voltage is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Equipment needed to check the protection circuit:

1. Isolator transformer.
2. High voltage meter.
3. Short jumper.
4. Diode connection jumper
   Use similar diode than D823, refer to parts list for part No., (Diode should support at least 150V.)

Procedure:

1. Connect receiver to Isolator Transformer.
2. Apply a monoscope pattern.
3. In Service Mode. (Refer to Service Mode Section) Select Register C0b.
4. Measure TP5 (TPs port close to tuner). Compare the measure of TP5 and set the data for C0b according the following table

TP 5 MEASURE (V)	DATA TO C0b (Hex)
0 ~ 0.93	00
0.93 ~ 0.97	01
0.97 ~ 1.01	02
1.01 ~ 1.05	03
1.05 ~ 1.09	04
1.09 ~ 1.13	05
1.13 ~ 1.17	06
1.17 ~ 1.21	07

5. Exit Service Mode and turn Receiver OFF.
6. Connect a jumper from TPD16 to TPD17.
7. Connect the *Diode jumper*, cathode to TPD14 (COLD GND), anode to TPD15 (HOT GND).

   Note: *Refer to Fig. 10 for Test Point Location.*
8. Apply 75 V AC to the AC input of the Insulator transformer.Turn receive ON.
9. Set PICTURE and BRIGTHNESS to minimum.
10. Increase the AC voltage at the input of Insulator transformer and confirm the HHS Voltage is **33.1KV** for **CT-2016SE, CT-2006SE, CT-20D11E/DE** and **32.4kV** for **CT-20R6E/CE, CT-20G6E/DE,** at the point set starts to loose sync,
11. Reset picture controls to original levels.
12. Turn the set OFF, and remove all jumpers and connections from chassis.

Receiver Feature Table

FEATURE\MODEL	CT-20R6E CT-20R6CE	CT-2016SE	CT-2006SE	CT-20G6E CT-20G6DE	CT-20D11E CT-20D11DE
Chassis No	AP359	FP360		DP359	EP360
Family	NA7D				
Tuning Block	40k				
Receiving System	NTSC				
# of channels	181				
Menu language	ENG/SPN/FRN				
Closed Caption	X				
V-Chip	USA/CANADA				
75 Ω input	X				
Remote Model #	EUR501450	EUR501455			EUR511502
Picture tube Type	PANABLACK				
Picture tube Supplier	SAMSUNG	AMEC	AMEC	SAMSUNG	AMEC
Comb Filter	2 Dig				
V/A norm	V				
FM Radio	-- --	X			
MTS/SAP/DBX	X				
Built-in audio power	1.5W x 2 (10%)				
# of speakers	2				
AI Sound	X				
A/V in (rear/front)	2(1/1)				
Audio Out (F:FAO/V:VAO)	---	---	---	---	F,V
S-VHS In (rear/front)	---	---	---	---	1/0
EPJ/HPJ/MISC	HPJ				
Dimensions mm (WxDxH) in	515.7x490.5x461.7 20.30x19.31x18.17				
Weight (kg/lbs)	18/39.6	20/44.09		18/39.6	19/41.8
Power source (V/Hz)	120/60				
Anode voltage	26.60 ± 1.25 kV	27.70 ± 1.25 kV	27.70 ± 1.25 kV	26.60 ± 1.25 kV	27.70 ± 1.25 kV
Video input jack	1Vp-p 75Ω, phono				
Audio input jack	500mV rms, 47KΩ				
A-Board TNP2AH024	DB*	DL*		DH*	DK*
C-Board TNP2AA075	AF*	AD*		AF*	AD*

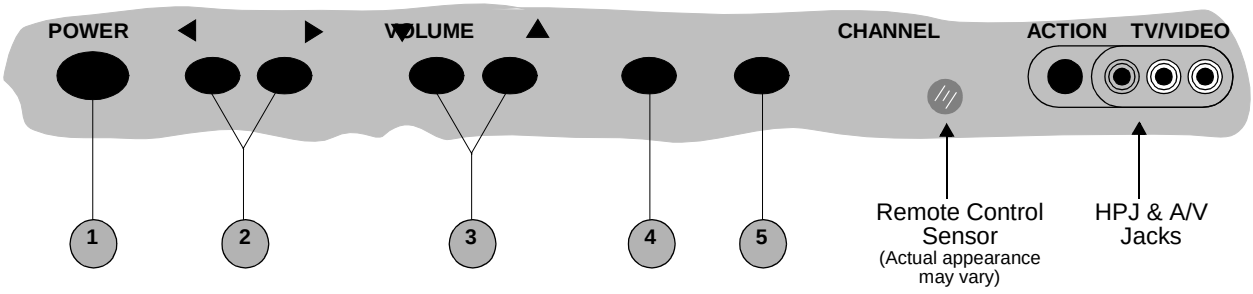
Table 1. **Receiver Features**

***Note:** When ordering a Board, add and " S" after the Board suffix application.*
Example, If Order A-Board for CT-20R6E, should be ordered as: TNP2AH024DBS.

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

Location of Controls (Receiver)

Figure 2. **Location of Controls (Receiver).**



Quick Reference Control Operation

Quick Reference Control Operation	
1	**Power Button -** Press to turn ON or OFF.
2	**Volume Buttons -** Press to adjust Sound Level, or to adjust Audio Menus, Video Menus, and select operating features when menus are displayed
3	**Channel Buttons -** Press to select programmed channels. Press to highlight desired features when menus are displayed. Also use to select Cable Converter box channels after programming Remote Control Infra-red codes (the TV/AUX/CABLE switch must be set in CABLE position).
4	**Action Button -** Press to display Main Menu and access On Screen feature and Adjustment Menus.
5	**TV/Video Button -** Press to select TV or Video Input.

Location of Controls (Remote)

Power Button
Press to turn ON and OFF.
Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption display.
Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.
Channel Buttons
Press to select channels. Use with volume buttons to navigate in menus.
Action Button
Press to display Main Menu and access or exit On Screen features and Adjustment Menus.
Keypad Buttons
Press desired channel number to randomly access any channel.
R-Tune (Rapid Tune) Button.
Press to switch to the previous channel.
Recall Button
Press to display Time, status of Sleep Timer, Channel, Video mode and Channel Caption (Station Identifier).

EUR501455
CT-2016SE & CT-2006SE
CT-20G6E & CT-20G6DE

EUR511502
CT-20D11E & CT-20D11DE

Figure 3. **Location of Controls (Remote).**

Location of Controls (Remote) Cont.

Power Button
Press to turn ON and OFF.
Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption display.
TV/Video Button
Press to select TV or Video input.
Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.
Channel Buttons
Press to select channels. Use with volume buttons to navigate in menus.
Action Button
Press to display Main Menu and access or exit On Screen features and Adjustment Menus.
Keypad Buttons
Press desired channel number to randomly access any channel.
R-Tune (Rapid Tune) Button.
Press to switch to the previous channel.
Recall Button
Press to display Time, status of Sleep Timer, Channel, Video mode and Channel Caption (Station Identifier).

EUR501450
CT-20R6E & CT-20R6CE

Figure 4. **Location of Controls (Remote)**.

Disassembly for Service

Back Cover

Remove all the screws marked with an arrow(◄) from the back of the receiver. See Fig. 8.

Note: *Screw configuration, type, and number of screws vary depending on the model of the Receiver serviced and the application; various models are covered in this Manual. Use same hardware when reassembling the receiver.*

- 2 screws at the top edge of the Receiver.
- 2 screws at the lower corners of the Receiver.
- 1 screw by the A/V jacks.
- 1 screw by the Fly-back assembly.

A-Board - Main Chassis

1. Pull carefully the tab in the chassis rail, at the left side of the main chassis, this will release the rail from the cabinet. See Fig 5.
2. Slide the chassis and rail completely out of the guide rails of the cabinet.
3. Stand the receiver on its edge. The underside of the board is completely accessible for component replacement.

Note: *Some tie-wraps that secure the wire dressings may need to be unfastened for chassis removal.*

4. When reassembly, place the chassis rail on the cabinet, then place the main chassis, be sure is in the rails at both sides, then push all the way to the front.

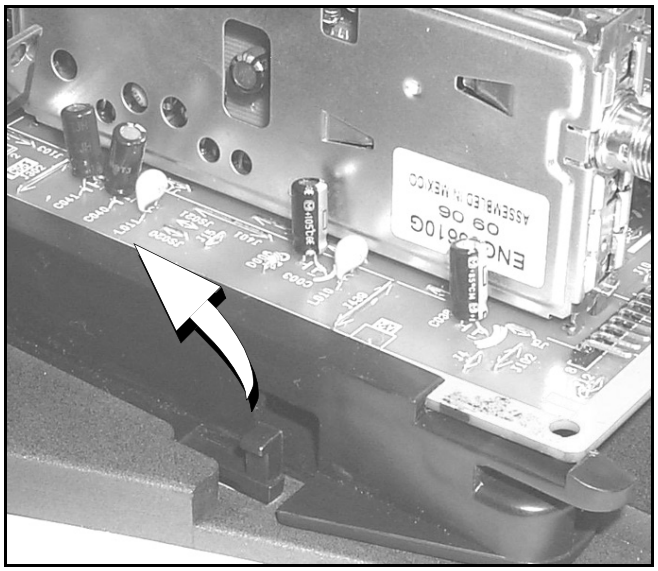


Figure 5. **Chassis Rail Detail**

C-Board - CRT Output

Plugs into the socket on the CRT neck.
To release the Focus wire, use a flat tool to release the tab in the socket, *See Fig. 6* ***A***, pull the wire-look up and remove the wire by pulling away the socket ***B,*** To re-insert, close the wire-look by pushing until is secured with the tab, and insert the wire into the socket

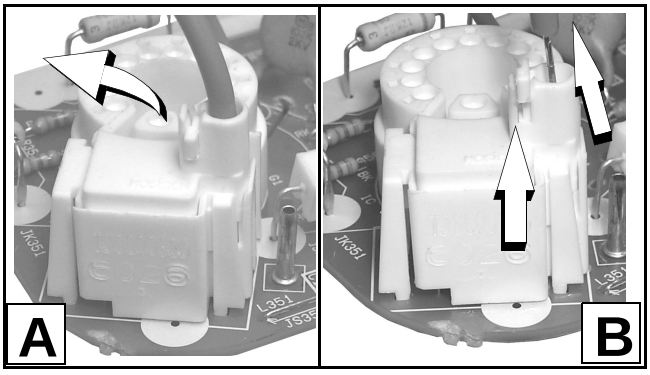


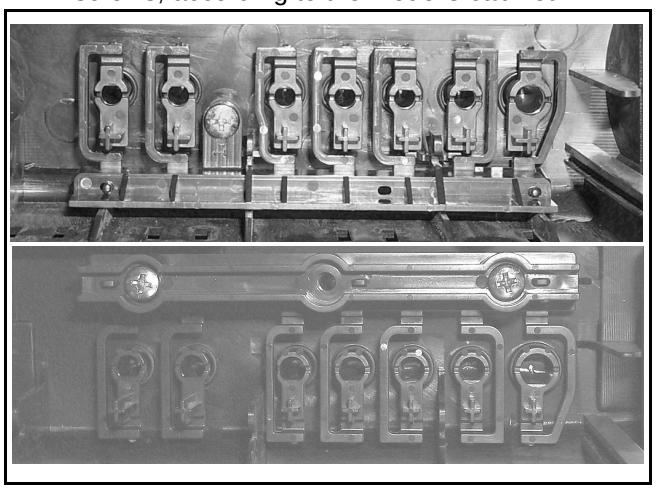
Figure 6. **Focus Wire Release**

Speakers

Speakers are secured to the cabinet's front with 2 screws in diagonal (opposite corners).

Keyboard Push Button Assembly

Fastened to the inside of the cabinet front with 1 or 2 screws, according to the model's cabinet.



Disassembly for CRT Replacement

1. Discharge the CRT as instructed in the **Safety Precautions** (see page 2).
2. Disconnect the yoke (DY) plug and degaussing coil (DEG) plug from the main board.
3. Unplug the CRT 2nd anode button.
4. Remove the C-Board from the CRT base and unplug the black wire (CRT dag ground) C10.
5. Disconnect Speakers plug SP from the A-Board.
6. Lift the Main Chassis (A-Board) completely out with the CRT Board attached.

CRT Replacement

1. Perform **Disassembly for CRT Replacement** procedure.
2. Insure that the CRT H.V. Anode button is discharged before handling the CRT. Read the **Safety Precautions** (see page 2) on handling the picture tube.
3. Remove the components from the CRT neck and place the cabinet face down on a soft pad.
4. Note the original order for the CRT mounting hardware.
5. Remove the CRT with the degaussing coil and the dag ground braid attached.
6. Note the original locations and mounting of the degaussing coil and the dag ground assembly to insure proper reinstallation on the replacement CRT.

   To remove and remount the degaussing coil: The degaussing coil is held in place by 4 plastic ties fastened to the CRT corner ears. To remove Coil cut the plastic ties.

   - 4 plastic ties are included in the Degaussing coil installation Kit (Refer to Parts List for correct Part No)-.

   To re-mount, place the two smaller plastic ties in the upper corners, holding the Coil, use the two bigger plastic ties to hold the Coil to the lower corners. Confirm the Coil is tense and fasten to the CRT body.

   To remove and remount the dag ground braid:
   a. Unhook the coil spring from the upper right corner of the CRT.
   b. Release the braid loop from the lower left corner of the CRT.

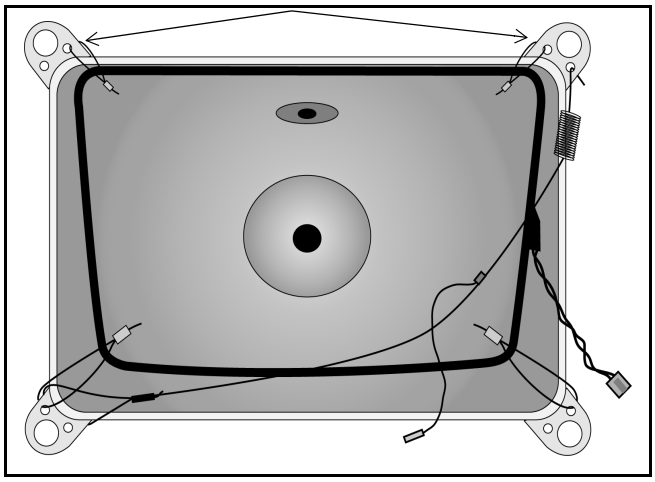


Figure 7. **Deg Coil and DAG GND**

7. Mount the dag ground braid on the replacement CRT as shown in Fig 7. Position the degaussing coil with new ties. Dress coil as was on the original CRT.
8. Replace the components on CRT neck and reinstall into cabinet. Verify that all ground wires and circuit board plugs get connected.

Back Cover Disassembly

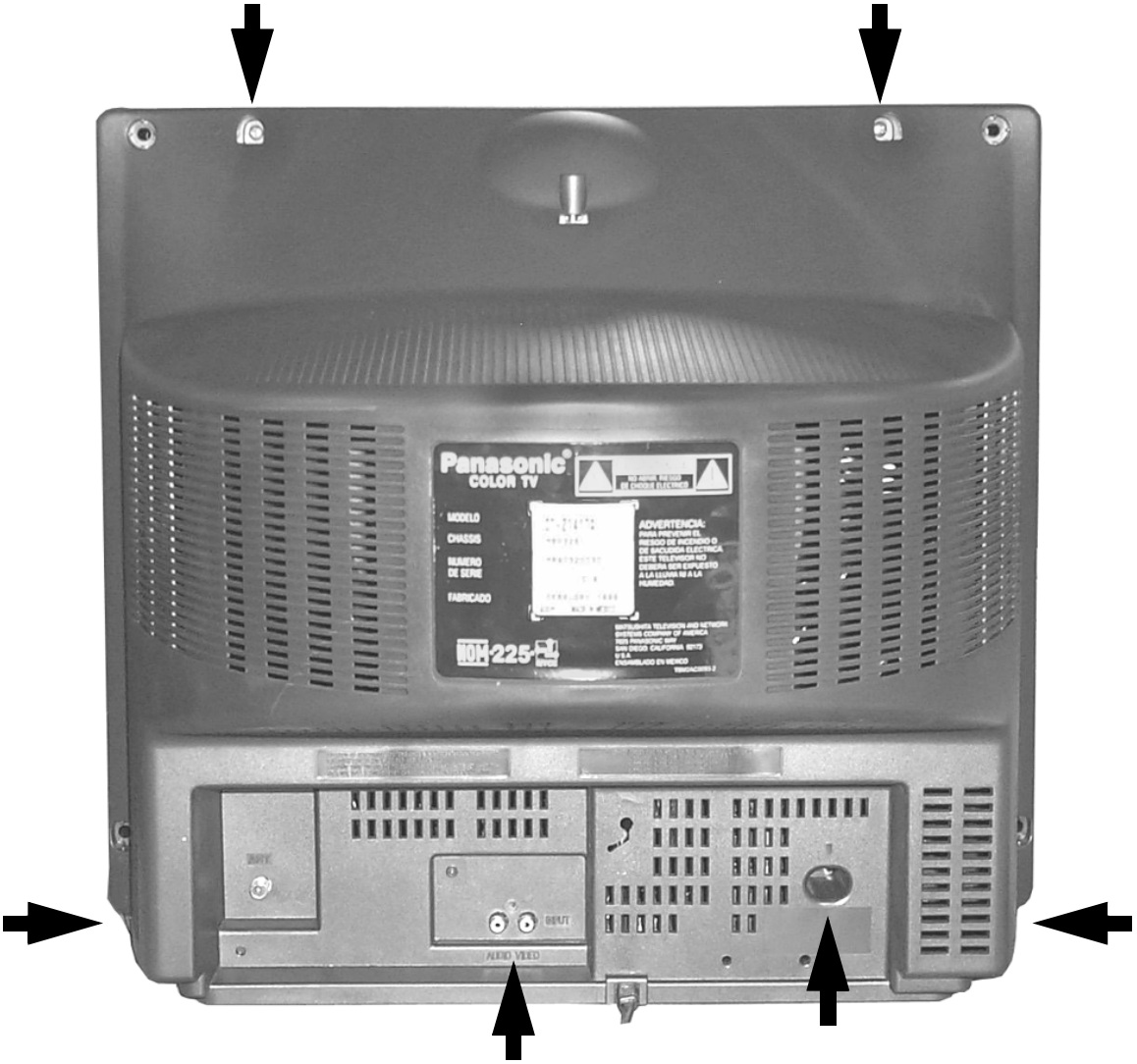


Figure 8. **Back Cover Removal**

- **2 Screw at the top edge**
- **1 Screw in each lower corner**
- **1 Screw by the A/V Jacks**
- **1 Screw by the Flyback Assembly.**

IMPORTANT
Screw number and configuration, A/V jacks and connectors may vary according to the model.

Main Components Location

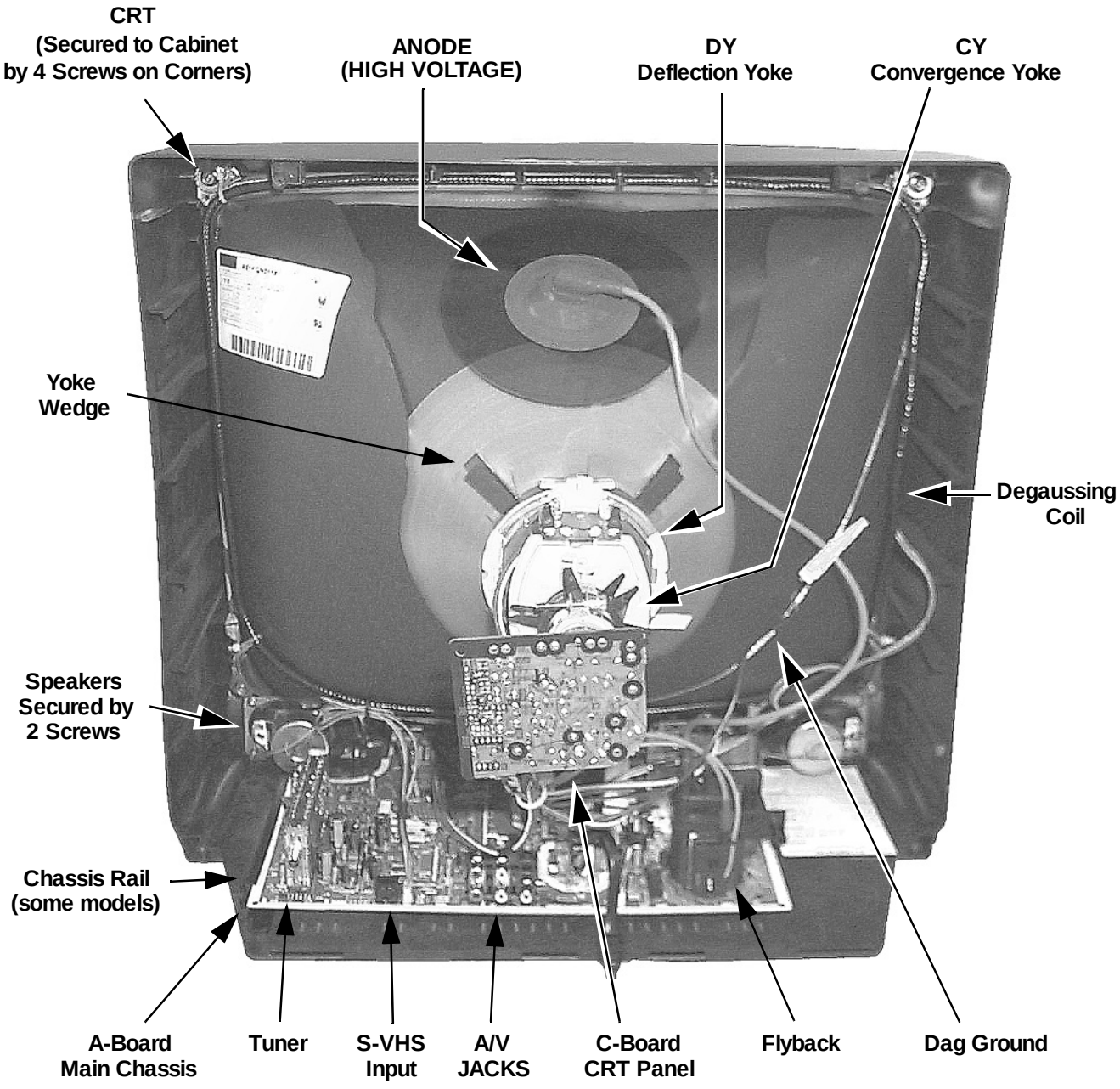
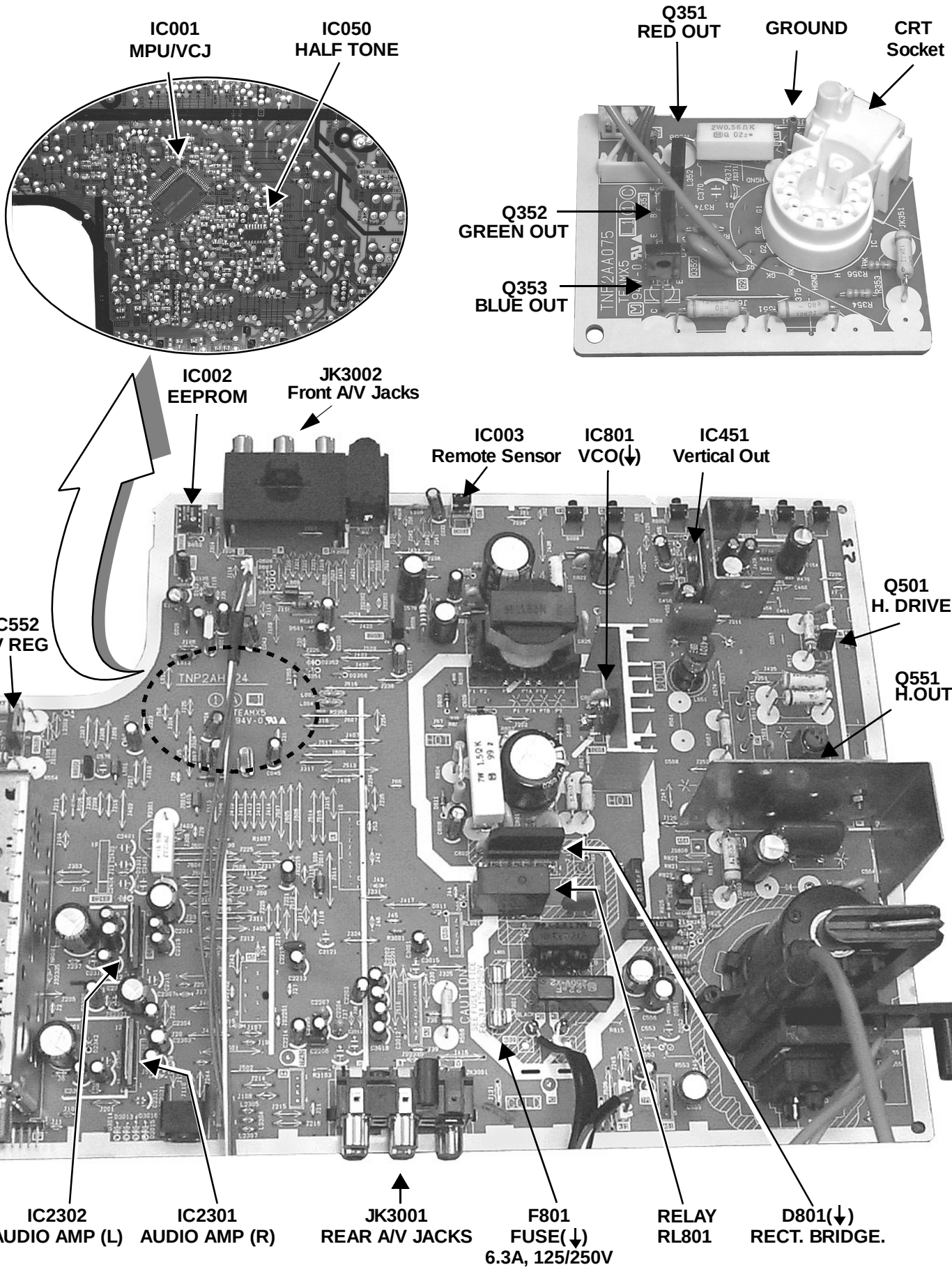


Figure 9. **Rear View**

Note: *Audio and Video Inputs may vary according to the model.*

IMPORTANT
After servicing the receiver, remember to dress the cables a shown above.

Main Components Location

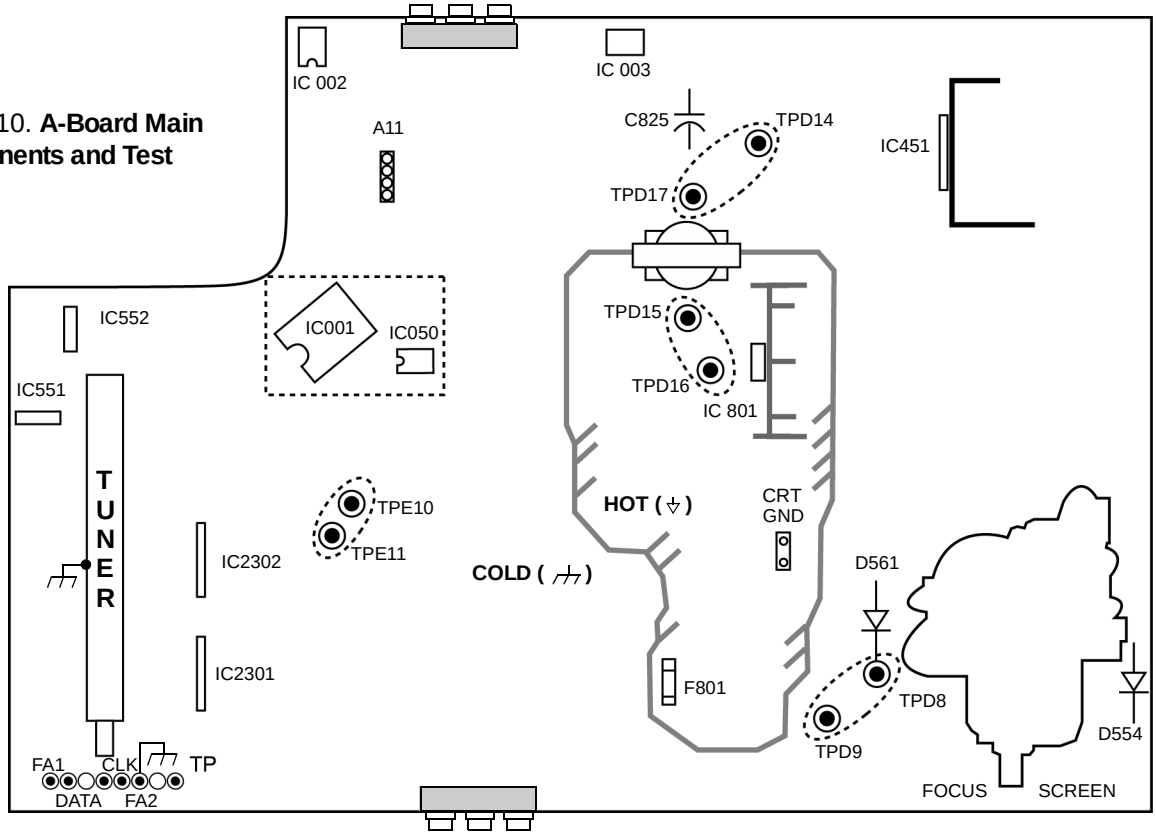


Chassis Service Adjustment Procedures

All service adjustments are factory preset and should not require adjustment unless controls and/or associated components are replaced.

Note: *Connect the (-) lead of the voltmeter to the appropriate ground. Use IC801's heat sink when the HOT ground symbol (⏚) is used. Otherwise, use COLD ground (⏚) — Tuner shield, IC451's heat sink or FA2.*

Figure 10. **A-Board Main Components and Test Points**



COMPONENTS WITHIN DOT LINES ARE LOCATED AT THE OPOSITE SIDE OF BOARD.

130.0V B+ Voltage Confirmation

1. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu.
2. Connect the DVM between **C825(+ side)** and cold ground (⏚).
3. Confirm that B+ voltage is **130.0V ± 2.5V**. This voltage supplies B+ to the Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu. Use cold ground (⏚) for the (-) lead of the DVM.

LOCATION	VOLTAGE
TPD8	26.0V ± 2V
TPD9	13.0V ± 2V
IC552 Pin3	5.0V ± 0.25V
IC551 Pin3	9.0V ± 0.25V
D554 Cathode	200V ± 15V

Adjust Picture Menu for normalized video adjustments.

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears.
3. Confirm B+ 130V is within limit.
4. Using a high voltage meter confirm that the High Voltage is:

26.60kV±1.25kV	**CT-20R6E/CE, CT-20G6E/DE** (Models with Samsung CRT)
27.70kV±1.25kV	**CT-2016SE, CT-2006SE, CT-20D11E/DE** (Models with AMEC CRT)

Purity and Convergence Procedure

Adjustment is necessary only if the CRT or the deflection yoke is replaced or if the setting was disturbed. The complete procedure consists of:

1. Vertical Raster Shift Adjustment. **(Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings)**.
2. Initial static convergence.
3. Setting the purity.
4. Final static convergence.

When the CRT or the Yoke is Replaced

Place the yoke on the CRT neck (do not tighten the clamp).

For a 2-piece assembly (see Fig. 11):

Position purity/convergence assembly as shown and tighten clamp snugly. Remove the hot-melt glue seal on assembly and position like tabs of purity device together at 12 o'clock to reduce its magnetic field effect.

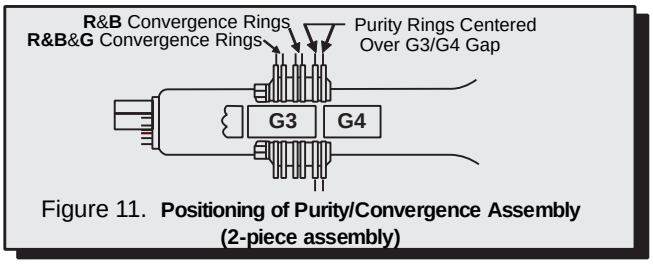


Figure 11. **Positioning of Purity/Convergence Assembly (2-piece assembly)**

For models using 4 pairs of rings, place the vertical raster shift tabs at 3 o'clock (90º from the purity and convergence tabs, see Fig. 12 and Fig. 13)

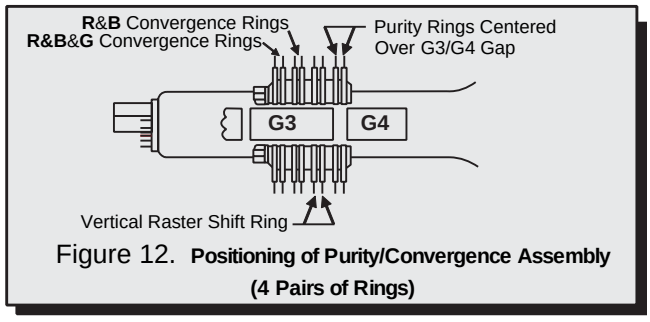


Figure 12. **Positioning of Purity/Convergence Assembly (4 Pairs of Rings)**

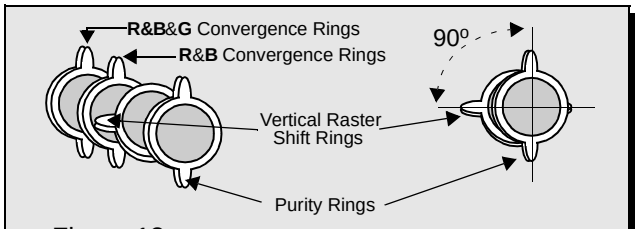


Figure 13. **Positioning of Purity/Convergence Assembly (4 Pairs of Rings)**

For a 1-piece assembly (see Fig. 14):

Position like tabs of purity devices together at 12 o'clock to reduce any magnetic field effect. (For better results, note part number and look for specifications at Service Center)

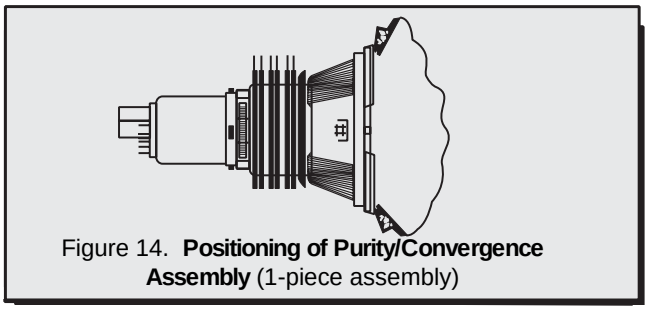


Figure 14. **Positioning of Purity/Convergence Assembly** (1-piece assembly)

For either assemblies:

Turn the Receiver ON. Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.

Fully degauss the Receiver by using an external degaussing coil.

Slide the deflection yoke back and forth on the neck of the CRT until it produces a near white, uniform raster.

Vertical Raster Shift Adjustment (Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings).

Apply a green pattern with a horizontal line, adjust the Deflection Yoke so that has no tilt, then secure it.

Adjust center line of the pattern with the mechanical center of the CRT, this center is determined by two marks at the side edges of the screen. To adjust the line, once the vertical raster shift tabs are place at 3 o'clock to reduce its magnetic field effect (see Fig. 12 and Fig. 13) open the tabs the same angle from the center, until the center line of the pattern becomes a straight line, centered with the marks of the CRT. (see Fig. 15)

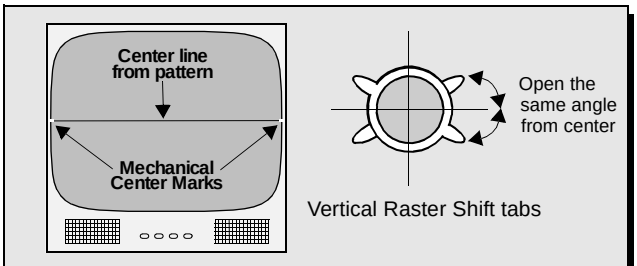


Figure 15. **Vertical Raster Shift Adjustment (4 pairs of rings assembly)**

Initial Center Static Convergence

Connect a dot/cross hatch generator to the Receiver and tune in a signal. Observe misconvergence at center of the screen only.
Adjust the R&B pole magnets; by separating tabs and rotating to converge blue with red.
Adjust the R&B&G pole magnets: by separating tabs and rotating to converge blue and red (magenta) with green.

> ***Note:*** *Precise convergence at this point is not important.*

Purity Adjustment

When the Receiver is in the Service Mode for making electronic adjustments, press the **Recall** button on the Remote Control to enter Purity Check. (See the **Service Adjustments Electronic Controls** procedure).
Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.
Fully degauss the Receiver by using an external degaussing coil.
Press the **Recall** button on the Remote Control again until the Purity Check (green screen) appears.

For a 2-piece assembly (see Fig. 11)**:**
Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.
Adjust the Purity rings to set the vertical green raster precisely at the center of the screen (see Fig. 16).

NOTES:
1. CRT warm up with white screen (three guns activated) is needed to stabilize the shadow mask expansion.
2. Initial center static convergence (roughly centers three gun beams) is required in order to perform purity adjustment.

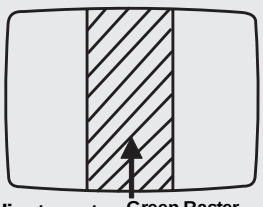


Figure 16. **Green Raster Adjustment**

Slowly move the deflection yoke forward until the best overall green screen is displayed.

For a 1-piece assembly (see Fig. 14)**:**
Slowly move the deflection yoke and purity rings assembly toward the CRT board and adjust the purity magnet rings to set vertical green raster at center of screen (see Fig. 16).
Gradually move the deflection yoke & purity rings forward and adjust for best overall green screen.

Continue from here for either assemblies:
Tighten the deflection yoke clamp screw.
Press the **Recall** button on the Remote Control again until the purity check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.
Press the **Recall** button on the Remote Control again until Purity check (white screen) appears. Observe the screen for uniform white. If purity has not been achieved, repeat the above procedure.

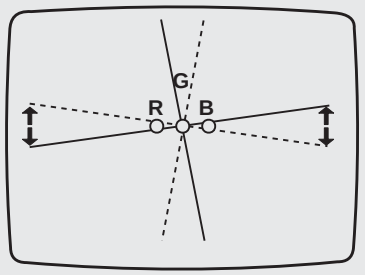
Final Convergence Procedure (see Fig. 17 through Fig. 19):

> ***Note:*** *Vertical size and focus adjustments must be completed prior to performing the convergence adjustment. Connect a dot pattern generator to the Receiver. The* ***Brightness*** *level should not be higher than necessary to obtain a clear pattern.*

Converge the red and the blue dots at the center of the screen by rotating the R&B pole Static Convergence Magnets.
Align The converged red/blue dots with the green dots at the center of the screen by rotating the R&B&G pole Static Convergence Magnets. Melt wax with soldering iron to reseal the magnets.
Slightly tilt vertically and horizontally (do not rotate) the deflection yoke to obtain a good overall convergence.
If convergence is not reached at the edges, insert permalloy (see following section) from the DY corners to achieve proper convergence. Recheck for purity and readjust if necessary.
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.
Secure the deflection yoke by inserting two side wedges at 3 and 7 o'clock positions.
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over the tab to secure to the CRT.

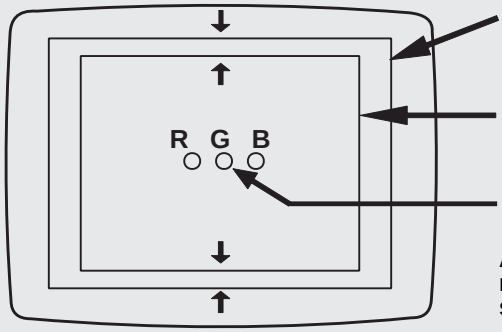
Permalloy Convergence Corrector Strip (Part No. 0FMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.
First converge the set without the strip and observe the corners.
If correction is needed:
1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.



As the yoke is tilted vertically, the rasters produced by the outside guns rotate in opposite directions.

Figure 17. **Vertical Yoke Movement**



Raster produced from one of the outside electron beams

Raster from the other side electron beam

Static convergence magnets are set for center convergence

As the yoke is tilted horizontally, one raster gets larger while the other gets smaller

Figure 18. **Horizontal Yoke Movement**

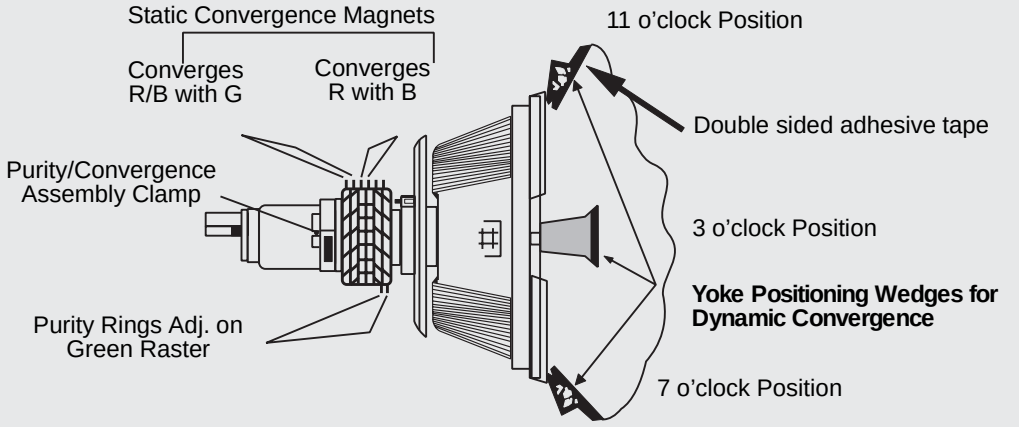


Figure 19. **Convergence Magnets and Wedges Location**

Note: *For models using 4 pairs of rings assemblies see Fig. 12 for*

Service Mode (Electronic Controls)

This Receiver has electronic technology using the I²C Bus Concept. It performs as a control function and it replaces many mechanical controls. Instead of adjusting mechanical controls individually, many of the control functions are now performed by using “On Screen Display Menu”. (The **Service Adjustment Mode**.)

Note: *It is suggested that the technician reads all the way through and understand the following procedure for Entering/Exiting the* ***Service Adjustment Mode****; then proceed with the instructions working with the Receiver. When becoming familiar with the procedure, the Flow Chart for Serviceman Mode may be used as a quick guide.*

Quick Entry to Service Mode:

At times when minor adjustments need to be done to the electronic controls, the method of Entering the service Mode without removal of the cabinet back is as follows using the Remote Control:

1. Select SET-UP icon and select CABLE mode.
2. Select TIMER icon and set SLEEP time for 30 Min.
3. Press ACTION button twice to exit menus.
4. Tune to the Channel 124.
5. Adjust VOLUME to minimum (0).
6. Press the VOL ◀ button (decrease) **on Receiver**. Red “CHK” appears in upper corner.

To toggle between Aging and Service modes:

While the “CHK” is displayed on the left top corner of the CRT, pressing the Action and the Volume Up buttons on the Receiver simultaneously will toggle between the modes. Red “CHK” for Service and yellow “CHK” for Aging (Aging mode is used in the factory for quick operation).

7. **Press** the **Power** Button on the **Remote Control** to select one of Service Adjustment Modes.
   1) **B**= Service VCJ SUB-DATA adjustments.
   2) **C**= Service VCJ CUT-OFF adjustments.
   3) **S**= Service OPTIONS (PICTURE) adjustments.
   4) **M**= Service MTS adjustments.
   5) **P**= Service VCJ adjustments.
   6) **X**= Service AFC adjustments
   6) “**CHK**” = Normal operation of CHANNEL ▲▼ and VOLUME ◀ ▶.

Note: *Only the applicable settings for the Receiver serviced will be available (See* **a** *in Fig. 20).*

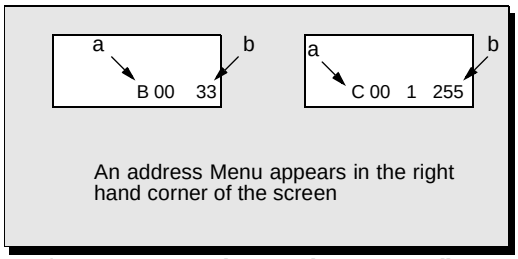


Figure 20. **Service Mode Menu Adjustments.**

Exiting the Service Mode:

Press the **Action** and the **Power** buttons on the **Receiver** simultaneously for at least 2 seconds.

THE RECEIVER EXITS SERVICE MODE.

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound. Any programmed channels, channels caption data and some others user defined settings will be erased.

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

IMPORTANT

Registers marked as **FIXED** in the following tables, are **factory preset**, service personnel **should not change** the default value.

Press the **Power Button** on the **Remote Control** to select the Service Adjustment.

For Adjustments:

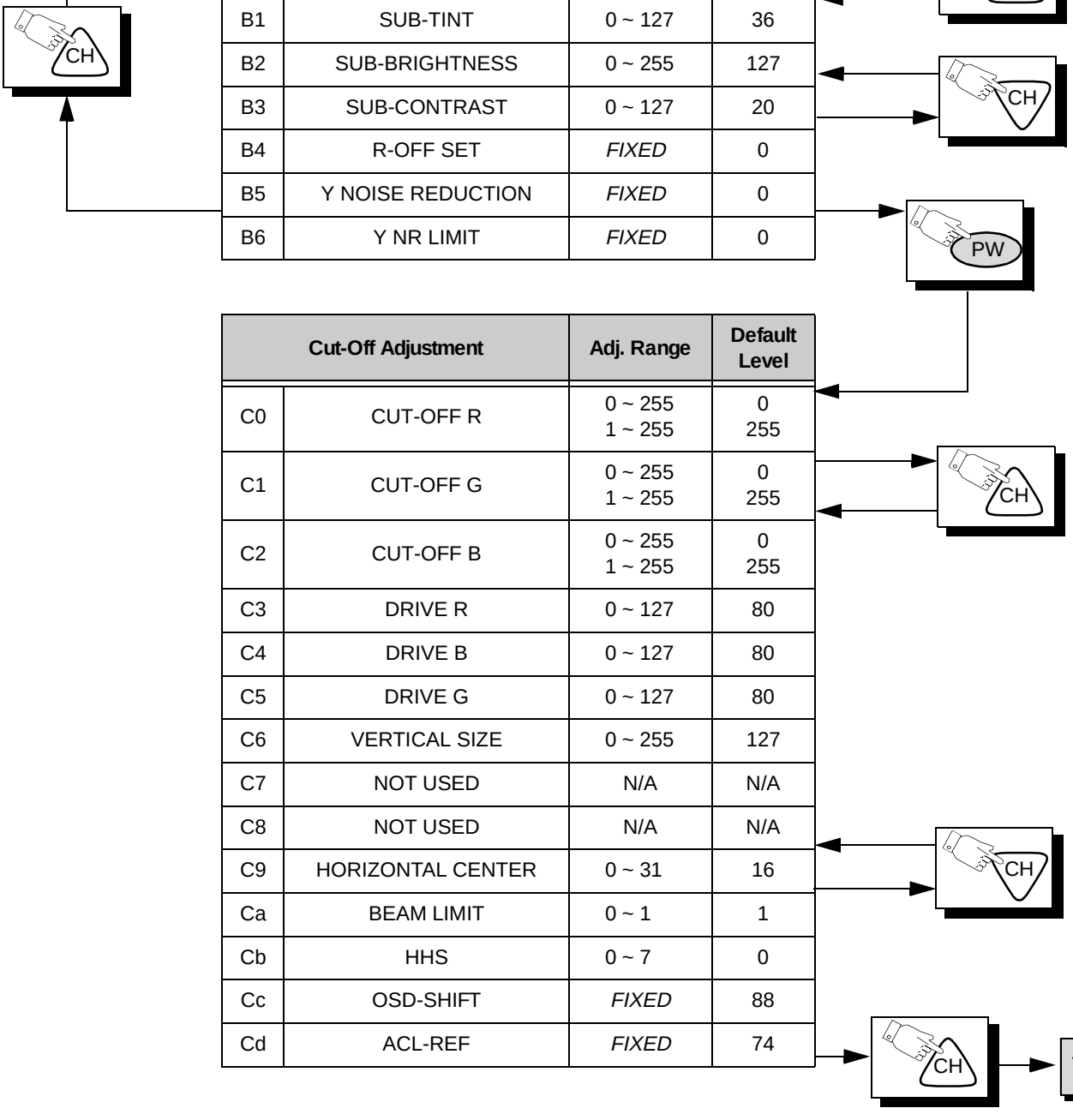
1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 20).

Note: *Write Down the original value set (**b** in* Fig. 20*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

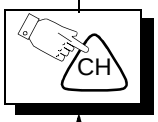
2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 20).

Sub-Data Adjustment		Adj. Range	Default Level
B0	SUB-COLOR	0 ~ 127	33
B1	SUB-TINT	0 ~ 127	36
B2	SUB-BRIGHTNESS	0 ~ 255	127
B3	SUB-CONTRAST	0 ~ 127	20
B4	R-OFF SET	*FIXED*	0
B5	Y NOISE REDUCTION	*FIXED*	0
B6	Y NR LIMIT	*FIXED*	0

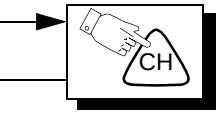
Cut-Off Adjustment		Adj. Range	Default Level
C0	CUT-OFF R	0 ~ 255 1 ~ 255	0 255
C1	CUT-OFF G	0 ~ 255 1 ~ 255	0 255
C2	CUT-OFF B	0 ~ 255 1 ~ 255	0 255
C3	DRIVE R	0 ~ 127	80
C4	DRIVE B	0 ~ 127	80
C5	DRIVE G	0 ~ 127	80
C6	VERTICAL SIZE	0 ~ 255	127
C7	NOT USED	N/A	N/A
C8	NOT USED	N/A	N/A
C9	HORIZONTAL CENTER	0 ~ 31	16
Ca	BEAM LIMIT	0 ~ 1	1
Cb	HHS	0 ~ 7	0
Cc	OSD-SHIFT	*FIXED*	88
Cd	ACL-REF	*FIXED*	74

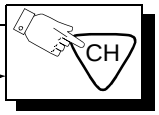


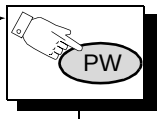
To Item **C00**

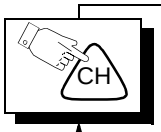


Cut-Off Adjustment		Adj. Range	Default Level
Ce	ACL-REF	*FIXED*	64
Cf	ACL-REF	*FIXED*	48
10	ACL-REF	*FIXED*	40
11	ACL-REF	*FIXED*	31
12	ACL-REF	*FIXED*	20
13	ACL-COEFFICIENT	*FIXED*	124
14	ACL-COEFFICIENT	*FIXED*	117
15	ACL-COEFFICIENT	*FIXED*	94
16	ACL-COEFFICIENT	*FIXED*	80
17	ACL-WAIT	*FIXED*	2
18	ACL-THRESH	*FIXED*	9
19	MACROVISION	*FIXED*	3
1A	OSD SELECT	*FIXED*	1
1B	KILLER ON	*FIXED*	6
1C	KILLER OFF	*FIXED*	20
1D	KILLER TIMER	*FIXED*	3
1E	ACC THRESH	*FIXED*	17
1F	ACC OFF	*FIXED*	7
20	MUTE TIME	*FIXED*	11

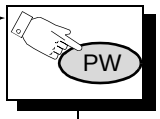






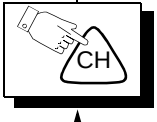


MTS Adjustment		Adj. Range	Default Level
M0	INPUT LEVEL	0 ~ 63	33
M1	HIGH-LEVEL SEPARATION	0 ~ 63	25
M2	LOW-LEVEL SEPARATION	0 ~ 15	6
M3	AGC	*FIXED*	0

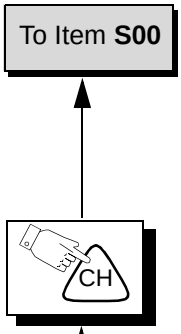


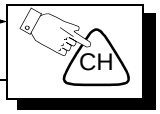
OPTIONS (PICTURE) Adjustment		Adj. Range	Default Level
S0	SHARPNESS PW	*FIXED*	3
S1	SHARPNESS OW	*FIXED*	3
S2	HALFTONE	*FIXED*	0
S3	TV C	*FIXED*	0
S4	TV Y	*FIXED*	0
S5	GAMMA	*FIXED*	13
S6	VIDEO Y	*FIXED*	0

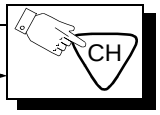
To Item **S8**

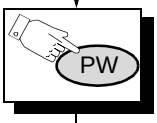


OPTIONS (PICTURE) Adjustment		Adj. Range	Default Level
S7	VIDEO C	*FIXED*	0
S8	COMB BPF	*FIXED*	0
S9	COMB 2D	*FIXED*	1
SA	COLOR KILLER LEVEL	*FIXED*	0
SB	PLL KILLER TRESH	*FIXED*	0
SC	ACC SW	*FIXED*	0
SD	ACC AMP OFF 1	*FIXED*	100
SE	ACC AMP OFF 2	*FIXED*	0
SF	ACC AMP ON	*FIXED*	20
10	ACC AMP CTL	*FIXED*	3
11	BGP POSITION (C)	*FIXED*	21
12	OSD R	*FIXED*	30
13	OSD G	*FIXED*	30
14	OSD B	*FIXED*	30
15	NOISE KILLER TIME	*FIXED*	5
16	NOISE KILLER	*FIXED*	50
17	HV TIMING	*FIXED*	2

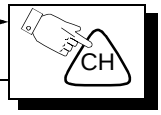


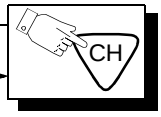


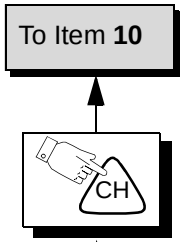




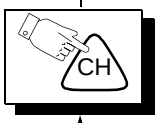
VCJ Adjustment		Adj. Range	Default Level
P0	FORCE BS	*FIXED*	1
P1	DET ON/OFF	*FIXED*	1
P2	ROM SEL	*FIXED*	3
P3	ROM CURVE	*FIXED*	2
P4	BS ON/OFF	*FIXED*	1
P5	BS TIME CONST	*FIXED*	5
P6	TH V	*FIXED*	4
P7	TH F1	*FIXED*	129
P8	TH F1	*FIXED*	1
P9	TH OFF1	*FIXED*	35
PA	TH F2	*FIXED*	99
PB	TH F2	*FIXED*	1
PC	TH OFF2	*FIXED*	30
PD	TH F3	*FIXED*	80
PE	TH F3	*FIXED*	1



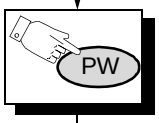




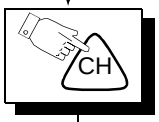
To Item **P00**



	VCJ Adjustment	Adj. Range	Default Level
PF	TH OFF3	*FIXED*	21
10	TH ON1	*FIXED*	37
11	TH ON2	*FIXED*	33
12	TH ON3	*FIXED*	25
13	CURVE1	*FIXED*	3
14	CURVE2	*FIXED*	3
15	CURVE3	*FIXED*	3
16	RATIO1	*FIXED*	0
17	RATIO2	*FIXED*	2
18	RATIO3	*FIXED*	3



	AFC Adjustment	Adj. Range	Default Level W/FM	Default Level WO/FM
X0	AFC T	0 ~ 127	83	60
X1	AFC B	0 ~ 127	44	29
X2	AFC C	0 ~ 127	64	42
X3	CLOCK	0 ~ 255	128	128



To **B** Items

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

Note: *Some adjustments modes may not be available in some models depending on available options.*

To Check Purity:

In Service mode (red “CHK” is displayed), place a jumper in AG connector, press the **Recall** Button on the **Remote Control** to enter to the White purity field check, remove the jumper, press **Recall** again to get to Red, Green and Blue purity fields (If jumper is not removed for color fields, they will be displayed with higher luminosity),

In Aging mode (*factory mode*, yellow “CHK” is displayed), connect a jumper in AG connector, press the **Recall** Button on the **Remote Control** to enter the Purity Field Check Mode.

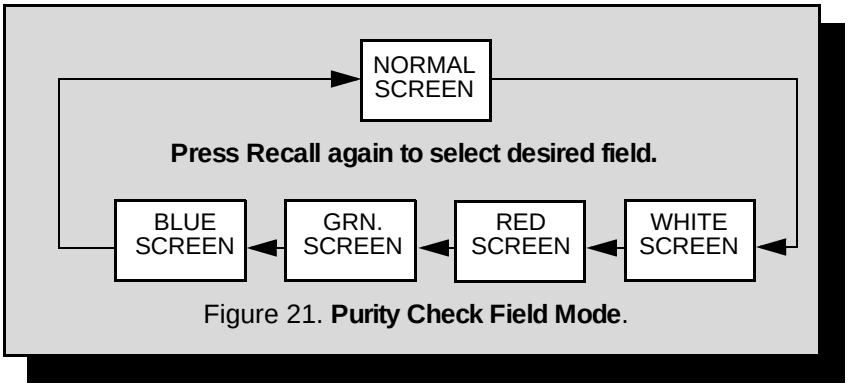


Figure 21. **Purity Check Field Mode**.

Helpful Hints

Entering Service Mode (Back-Open Method)

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point **FA1** (TP8) to Cold Ground (⏚) **FA2** (TP3) A-Board.
   The Receiver enters the Aging Mode.
   Yellow letters “CHK” appear in the upper left corner of the CRT.
   (The Volume Up/Down will adjust rapidly).
2. Simultaneously press the **Action** and the **Volume Up** buttons on the **Receiver** Control Panel.
   The Receiver enters the Service Mode.
   The letter in “CHK” turn red.
   (The Volume Up/Down will adjust normally).
   (All costumer controls are set to nominal level).

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

Instructional Flow Chart for Service Mode

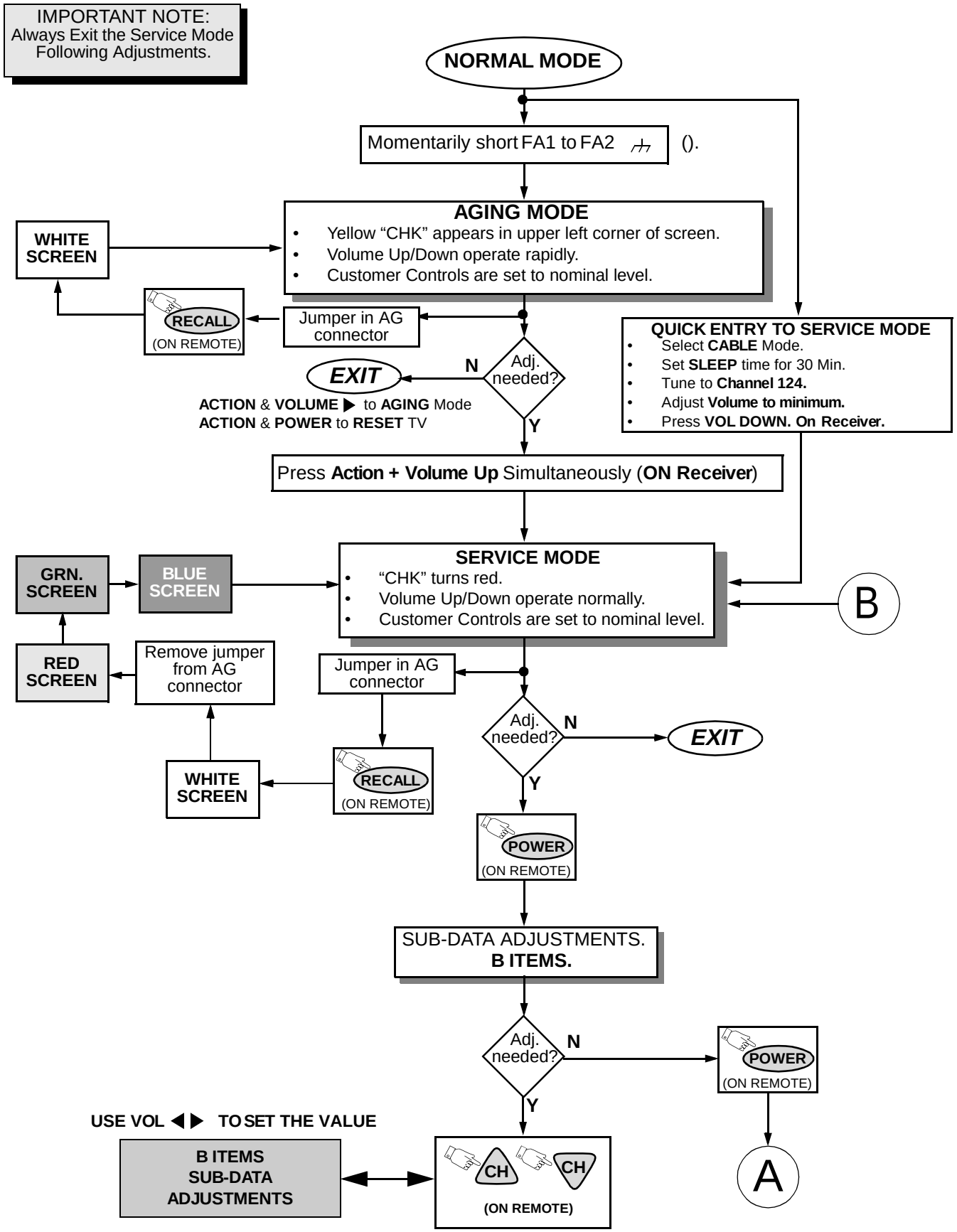


Figure 22.**Flow Chart for Serviceman Mode**.

Instructional Flow Chart for Serviceman Mode - Continued

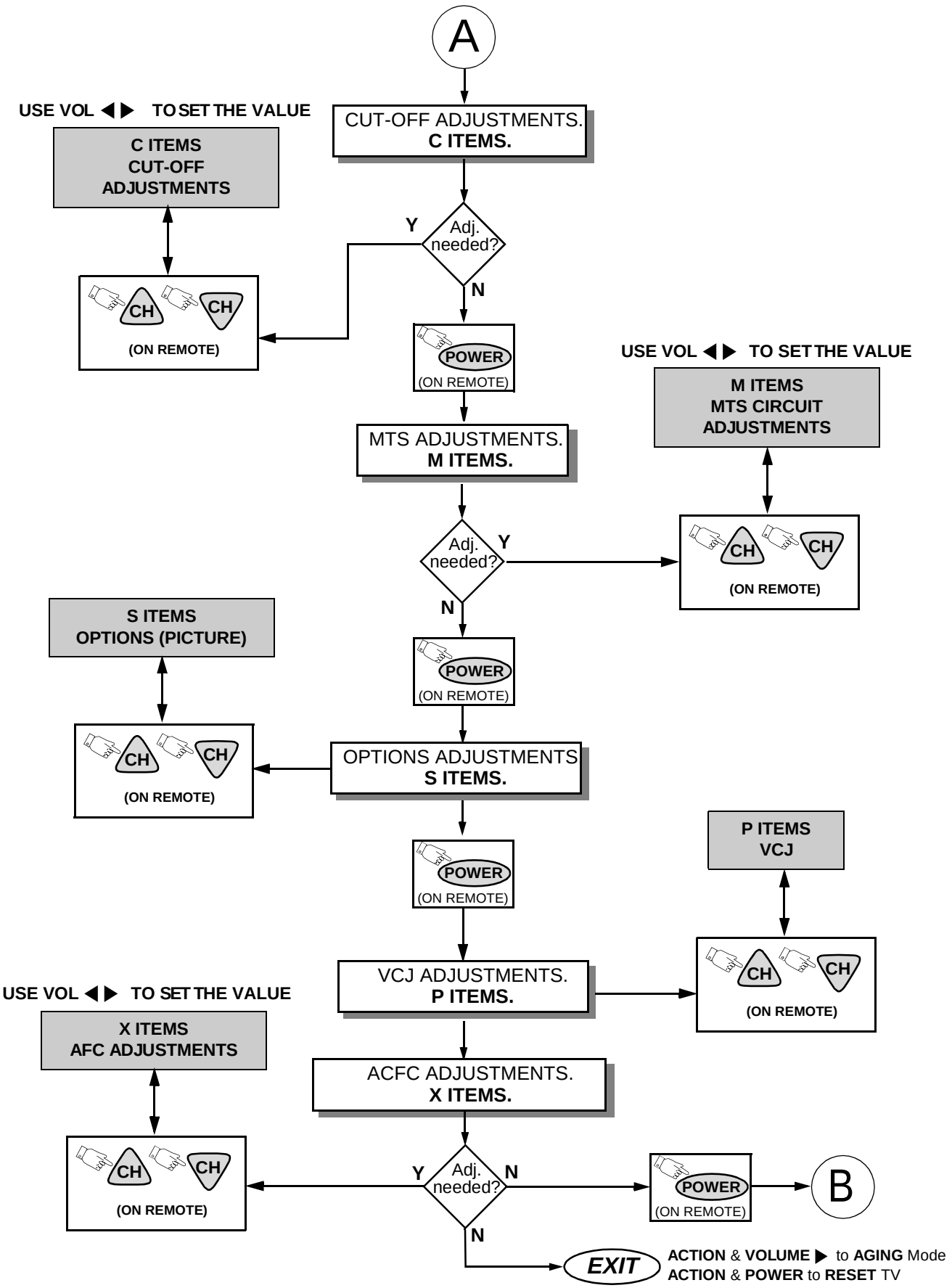


Figure 23. **Flow Chart for Serviceman Mode**.(Continued)

Service Adjustments (Electronic Controls)

Note: *Is recommended to allow at 30 min. warm up at highest bright (using white screen) before perform any picture adjustment.*

Sub-Contrast

Service DAC (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or when the CRT is replaced.

Preparation:

1. Apply a color bar signal pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

   Note: *The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to the pattern used if another signal is used.*

2. Preset the following controls:
   - Brightness . . . . . .Center.
   - Picture . . . . . .Max.
   - Sharpness . . . . . .Center.
   - Gamma, *S5* 15
   - ACL OFF *CA* 00
   - Cut Off G *C1* 00
3. Connect the scope probe between TP35 (C-Board) and cold ground (⏚).

Procedure:

1. In the Service Mode, select DAC Sub-Contrast Adjustment (B3) and adjust for **2.5Vp-p ±0.1V** from white level to black level on video waveform (see video waveforms detail, Fig. 24).

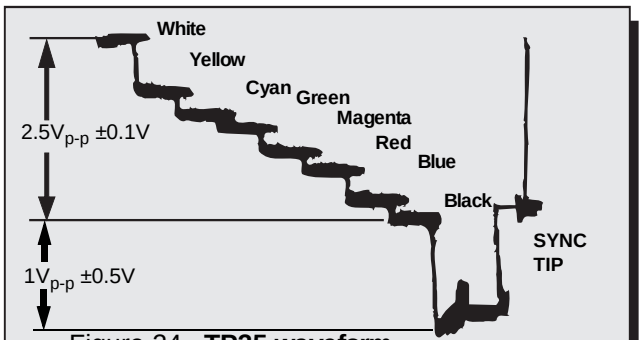


Figure 24. **TP35 waveform**

2. Following adjustments, set Service Registers to original values (Preparation step 2).
3. Turn the set Off. Remove all connections from chassis.

Sub-Brightness

Service DAC (B2)

Due the characteristics of this chassis, Sub-Brightness adjustment is no required. To obtain a good brightness level in the picture, set the Service Register to the default level: 127.

Perform "Final Sub-brightness adjustment" only if prefer different level of brightness in the picture.

Tint/Color Adjustment

Service DACs (B1) (B0)

Preparation:

1. Apply a rainbow color bar signal.
2. Preset the following controls:
   - Brightness . . . . . .Min.
   - Color . . . . . .Center.
   - Tint. . . . . .Center.
   - Picture . . . . . .Max.
   - Sharpness . . . . . .Min.
   - Gamma S5 15
   - ACL OFF CA 00
3. Connect the oscilloscope probe between TP37 (C-Board) and cold GND (⏚).

Procedure:

1. In the Service Mode, select DAC B1, Sub-Tint Adjustment. Adjust until the waveform measured is as the one shown in Fig. 25.

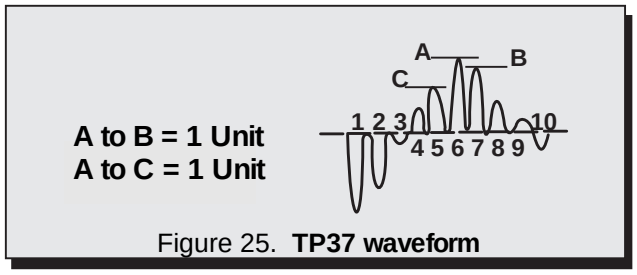


Figure 25. **TP37 waveform**

2. Connect the oscilloscope to TP35 (C-Board).
3. Select DAC Sub-Color Adjustment (B0) and adjust for peak to peak amplitude to be **0.8Vp-p ±0.05V** as shown in Fig.26.

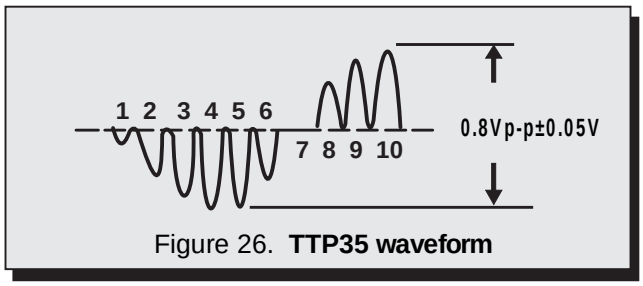


Figure 26. **TTP35 waveform**

4. Following adjustments, set Service Registers to original values (Preparation step 2).
5. Turn off the set. Remove all connections from chassis.

Service Adjustments (Electronic Controls, cont.)

White Balance

Service DACs. (C0) (C1) (C2) (C3) (C4) (C5)

Preparation:

1. Turn the Receiver "ON" and allow 30 minutes warm up at high brightness (White screen).
2. Preset the following Service DACs:
   - C0. . . . . 0 255
   - C1. . . . . 0 255
   - C2. . . . . 0 255
   - C3. 80
   - C4. 80
   - C5. 80
3. Confirm with Black-White pattern and a White Screen the actual balance (Gray scale and white level). If White Balance is required perform the Procedure steps as follow.

Procedure:

CUT-OFF Adjustment (Low Lights)

1. Apply a Black-White pattern.
2. Connect a jumper from Q452-Base to cold ground (⏚). (*Or apply +2.5 V dc to TP1 and cold ground (⏚)*) to dis-habilitate the Neck Protector circuit.
3. Set Red Cut-Off (C0) and Blue Cut-Off (C2) registers to 00.
4. Press R-Tune in the remote control (to close the vertical circuit and get green horizontal line),
5. Connect scope probe between GK (C-Board) and cold ground (⏚).
6. Measure waveform and adjust Register G-Cut Off, C1, for the scanning period to be 175V, as shown in Fig. 27

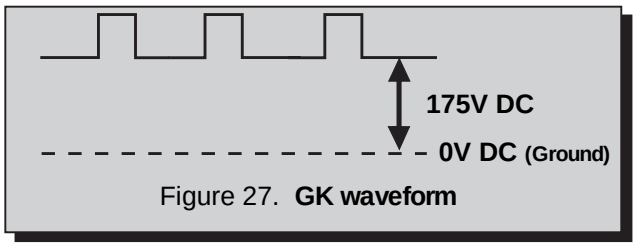


Figure 27. **GK waveform**

7. Adjust Screen VR (at T551, Flyback) until the green line just becomes visible.
8. Press R-Tune in remote to open vertical.
9. Select Red Cut-Off (C0) register, press R-Tune to see green horizontal line. Increase C0 (volume▶) until the line just become yellow (By mixing green and red).
10. Press R-tune to open the vertical.
11. Select Blue Cut-Off (C2) register, press R-Tune to close the vertical and see the yellow line, Increase C2 (volume ▶) until line just becomes white (mixing Green, Red and Blue).
12. Press R-Tune to open the vertical.
13. Confirm that a good gray scale is established by viewing Black-White pattern.

White Balance (High Lights)

1. Using a Black-White pattern and White screen, adjust Red Drive (C3) and Blue Drive (C5) to obtain correct white level on the screen.
   Observe High light areas, if white turns reddish, decrease Red Drive register, on the other hand, if white turns bluish, decrease Blue Drive register.
2. Exit Service mode.
3. In Picture menu, adjust Picture and Bright menu adjustments from low scale to high scale and check the Black and White tracking.
4. If correction is needed repeat step 1 until obtain a correct balance.
5. After High lights adjustment is satisfactory, perform Touch-Up procedure as follow.

White Balance Touch-Up procedure

(This procedure can be used as a Minor Adjustment Procedure if required)

1. Enter Service mode
2. Apply a Black and white image signal (Recommended with gray tones also).
3. Observe Low and High brightness areas for proper tracking.
   - HIGHT LIGHT areas - Adjust Red Drive register (C3) and Blue Drive register (C5) for warm whites.
   - LOW LIGHT areas - Adjust Red Cut-Off register and Blue Cut-Off register for proper black-gray.,

Since Low level adjustment has a minor effect on High light adjustment levels than vice versa, is recommend perform this adjustment at the end.

4. Exit Service Mode.Turn off the set. Remove all connections from chassis.

Service Adjustments (Electronic Controls, cont.)

Sub-Brightness Final adjustment
Service DAC (B3)

Perform this adjustment at the end. After all picture adjustments.

Preparation:

1. Turn the receiver ON and allow 20 min. warm up at high brightness (white screen).
2. Apply a Black-White cross Pattern
3. Preset the following controls for best results:
   - Picture . . . . . Max
   - Bright . . . . . Center

Procedure:

1. In Service mode, select Sub bright Register, B2
2. Adjust register until get the 7.5 IRE section looks the same light output than 3 Ire section. See Fig. 28

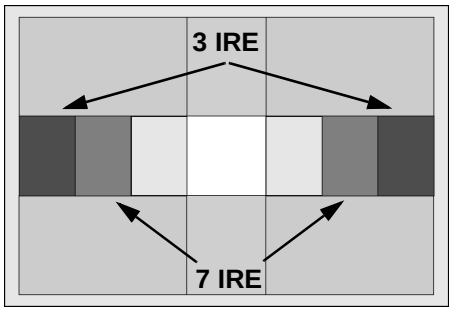


Figure 28. **Sub-bright adjustment**

3. Exit Service Mode.

Horizontal Centering

Service DAC (C9)

Preparation:

Connect a monoscope pattern.

Procedure:

1. In the Service Mode select the Horizontal Centering Adjustment DAC (C9) and adjust until the center of the pattern is centered on CRT. Distance A should be same than B.

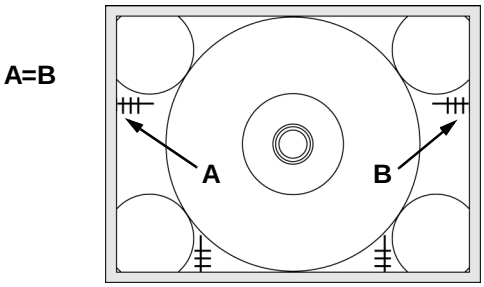


Figure 29. **Horizontal Centering**

2. Exit Service Mode.

Vertical Size

Service DAC (C6)

Preparation:

Connect a monoscope pattern.

Procedure:

1. In the Service Mode select Vertical Size Adjustment DAC (C6) and adjust until obtain a perfect round picture.(Upper and lower section of the pattern may go out of the visible are)

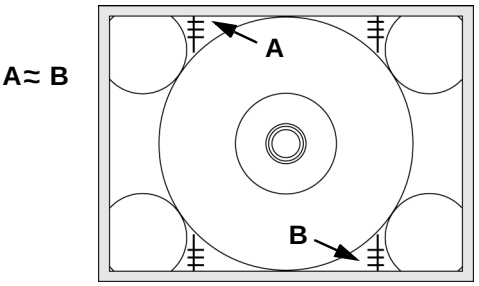


Figure 30. **Vertical Size**

2. Exit the Service Mode.

MTS Circuit Adjustments (Stereo Models only)

The MTS Circuit Adjustments require two steps:

1. Input Level Adjustment.
2. Stereo Separation Adjustment.

Input Level Adjustment (M0) (Stereo Models only)

Preparation:

1. Connect an RMS meter with filter jig as shown in Fig. 31.

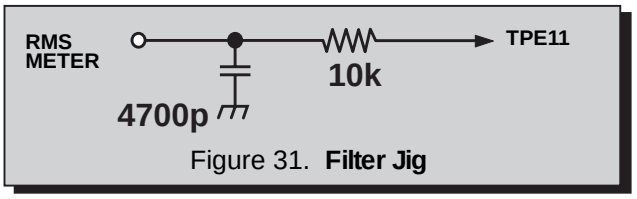


Figure 31. **Filter Jig**

2. Connect an RF signal generator to the RF antenna input.

Procedure:

1. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 300Hz, 100% modulation, monaural (70 ±5dB, 75Ω OPEN, P/S 10dB).
2. Adjust the MTS Input Level Adjustment (M0) until the voltage measured is 106 ± 6.0mV rms.

Service Adjustments (Electronic Controls, cont.)

Stereo Separation Adjustment (M1 & M2) (Stereo Models only)

Preparation:

1. Connect an RF signal generator to the RF antenna input.
2. Connect a scope between to TPE10 and cold ground (⏚).

Procedure:

1. Select Stereo Mode in Audio menu
2. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 300Hz, 100% modulation, stereo (left only) (70 ±5dB, 75Ω OPEN, P/S 10dB).
3. Adjust the MTS Low-Level Separation Adjustment (M2) until the amplitude displayed on the scope is minimum.
4. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 3KHz, 100% modulation, stereo (left only) (70 ±5dB, 75Ω OPEN, P/S 10dB).
5. Adjust the MTS High-Level Separation Adjustment (M1) until the amplitude displayed on the scope is minimum.
6. Repeat above steps 2 through 5 until the amplitude is at minimum for both signals.
7. Exit Service Mode. Turn off the set. Remove all connections from chassis.

Clock Adjustment

Service DAC (X3)

Preparation:

Connect the frequency counter from TP5 (TPs port close to tuner) to cold ground(⏚).

Note: *Frequency Counter probe capacitance should be 8pF or less.*

Procedure:

1. Measure TP5 for the frequency of the waveform and record the reading.

   Note: *Measurement must have at least four digits of resolution following the decimal point. Example: 000.0000*

2. In Service Mode select the Clock Adjustment DAC (X3).
3. Calculate and set X3 based on the following formula:

$$X3 = 128 + 0.90 \times 10^{6\frac{\{TP-(125)\}}{((125))}}$$

Note: *TP5 measurement will not change regardless of the value stored in X3.*

Service Adjustments (Mechanical Controls)

Focus (part of T551)

Preparation:

Apply a monoscope pattern.

Procedure:

1. Adjust the Focus VR, trying to get the better focus as possible at the right side.
2. Confirm a correct focus at the center, then try to adjust “A” in Fig. 32

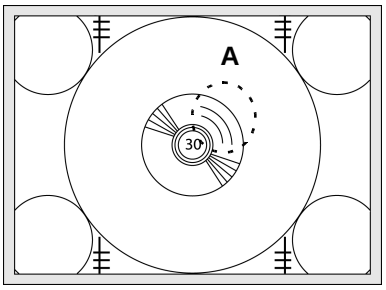


Figure 32. **Focus Adjustment**

AUDIO SIGNAL PATH BLOCK DIAGRAM

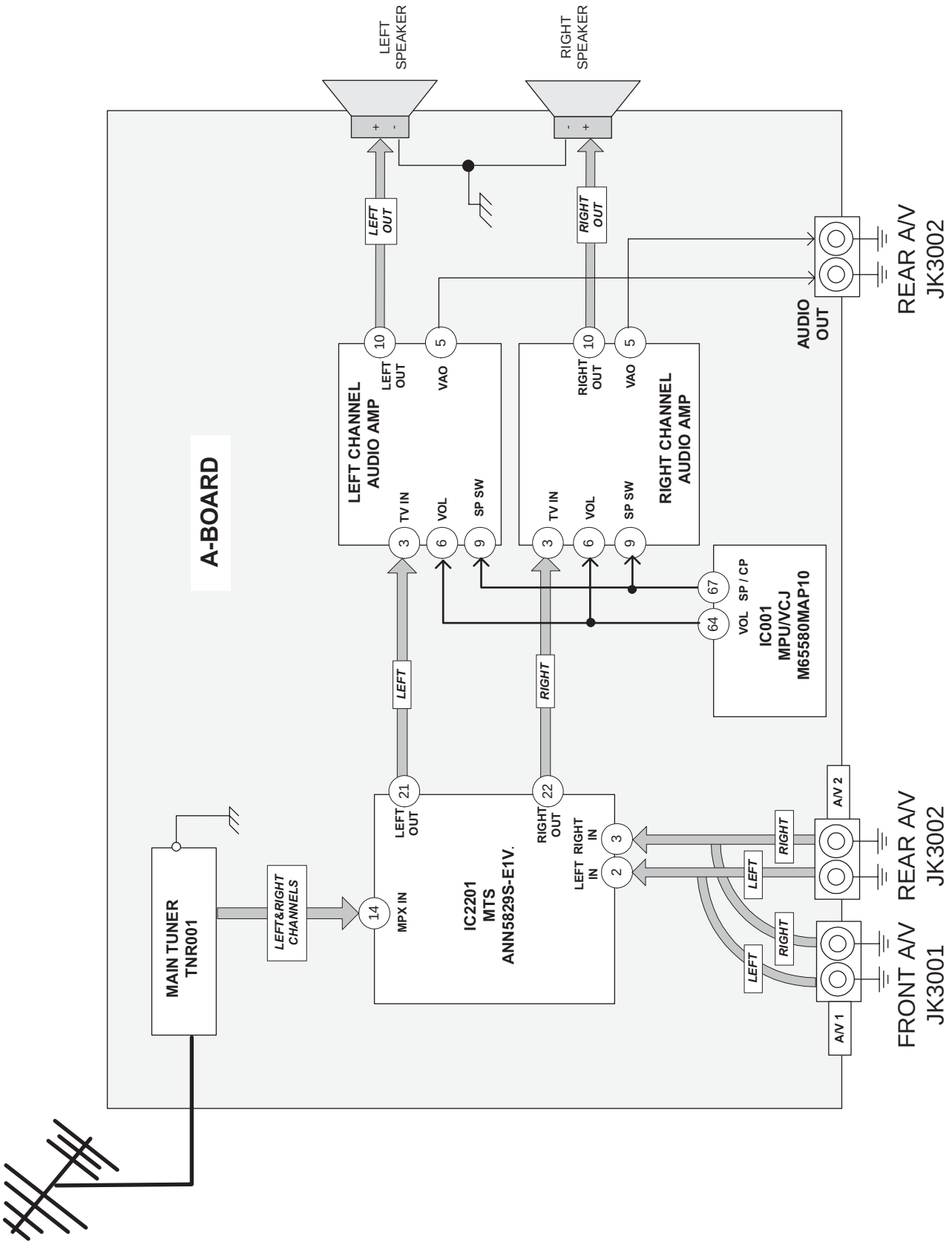


Figure 33. **Audio Signal Block Diagram**

VIDEO SIGNAL PATH BLOCK DIAGRAM

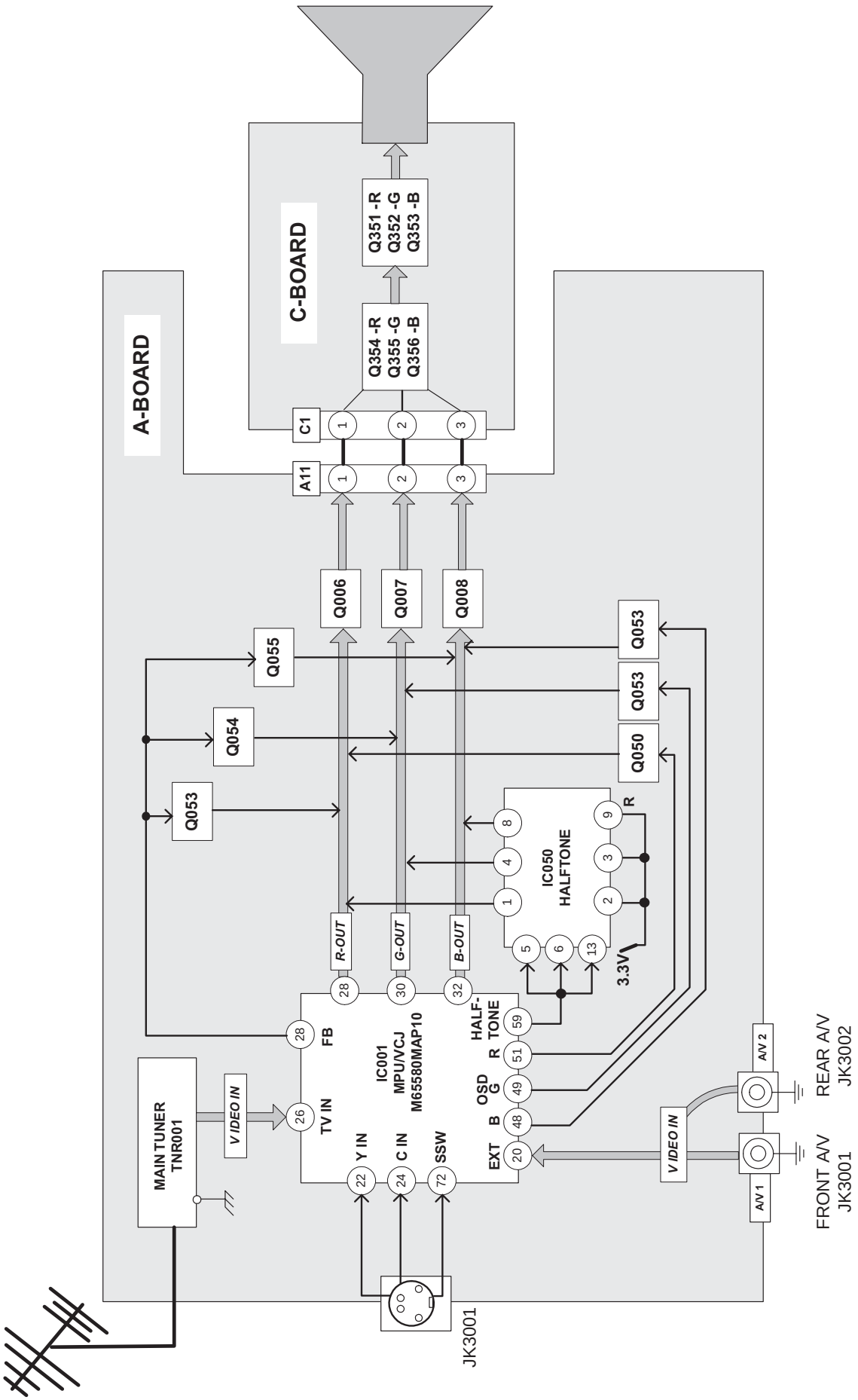


Figure 34. **Video Signal Block Diagram**

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
	CAPACITORS	
C001	**ECJ2VF1H103Z**	**CAP,C .01UF-Z-50V**
C002	ECJ2VB1H471K	CAP,C 470PF-K-50V
C003	ECA1HM4R7B	CAP,E 4.7UF-50V
C004	ECJ2VC1H150J	CAP,C 15PF-J-50V
C005	ECJ2VC1H150J	CAP,C 15PF-J-50V
C008	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C009	ECA1CM470B	CAP,E 47UF/16V
C010	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C011	ECA1CM101B	CAP,E 100UF/16V
C015	ECJ2VB1C224K	CAP,C .22UF-K-16V
C016	ECJ2VC1H101J	CAP,C 100PF-J-50V
C017	ECJ2VB1C104K	CAP,C .1UF-K-16V
C020	ECJ2VB1C104K	CAP,C .1UF-K-16V
C022	ECJ2VC1H101J	CAP,C 100PF-J-50V *CT-20G6DE CT-2016SE*
C024	ECA1CM470B	CAP,E 47UF/16V
C025	ECJ2VB1C104K	CAP,C .1UF-K-16V
C026	ECJ2VB1C104K	CAP,C .1UF-K-16V
C027	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C028	ECJ2VB1C104K	CAP,C .1UF-K-16V
C029	ECQB1H333JM3	CAP,P .033UF-J-50V
C031	ECA1HMR22B	CAP,E .22UF-50V
C032	ECA1VM470B	CAP,E 47UF/35V
C033	ECJ2VC1H390J	CAP,C 39PF-J-50V
C034	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C035	ECA1HM010B	CAP,E 1UF-50V
C036	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C037	ECA1HM0R1B	CAP,E 0.1UF/50V
C038	ECA1VM470B	CAP,E 47UF/35V
C040	ECA1CM470B	CAP,E 47UF/16V
C041	ECA1HM2R2B	CAP,E 2.2UF-50V
C042	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C043	ECA1CM470B	CAP,E 47UF/16V
C044	ECJ2VC1H471J	CAP,C 470PF-J-50V
C045	ECA1HM0R1B	CAP,E 0.1UF/50V
C046	ECJ2VB1C104K	CAP,C .1UF-K-16V

REF NO.	PART NO.	DESCRIPTION
C047	ECJ2VC1H220J	CAP,C 22PF-J-50V
C048	ECJ2VC1H220J	CAP,C 22PF-J-50V
C050	ECA1CM101B	CAP,E 100UF/16V
C051	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C054	ECJ2VF1H103Z	CAP,C .01UF-Z-50V *CT-20G6E CT-20G6DE* *CT-2006SE CT-2016SE* *CT-20D11E CT -20D11DE*
C055	ECJ2VC1H560J	CAP,C 56PF-J-50V
C103	ECA0JM331B	CAP,E 330UF-6.3V
C104	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C105	ECA0JM101B	CAP,E 100UF-6.3V
C201	ECJ2VC1H332J	CAP,C 3.3UF-J-50V0 *CT-20R6E CT-20R6CE*
C350	ECA1CM101B	CAP,E 100UF/16V *CT-20G6DE CT-2016SE*
C351	ECJ2VB1H391K	CAP,C 390PF-K-50V
C352	ECJ2VB1H391K	CAP,C 390PF-K-50V
C353	ECJ2VB1H471K	CAP,C 470PF-K-50V
C354	ECKW3D102KBN	CAP,C .001UF-K-2KVDC
C357	EEANA1E1R0B	CAP,E 1.0UF-25V
C361	ECJ2VC1H151J	CAP,C 150PF-J-50V
C362	ECJ2VC1H151J	CAP,C 150PF-J-50V
C363	ECJ2VC1H151J	CAP,C 150PF-J-50V
C451	ECA1CHG470B	CAP,E 47UF-16V
C452	ECSF1EE105VB	CAP,E 1.0UF-25V
C453	ECEA1HFS2R2B	CAP,E 2.2UF-50V
C454	ECA1EM101E	CAP,E 100UF-25V *CT-20G6E*
C454	ECA1EM102E	CAP,E 1000UF-25V *CT-20D11DE* *CT-20G6DE CT-20R6E* *CT-20R6CE CT-2006SE* *CT-2016SE CT-20D11E*
C455	ECA1EHG101B	CAP,E 100UF-25V
C456	ECQB1H103JM3	CAP,P .01UF-J-50V
C459	ECA1VHG471E	CAP,E 470UF-35V
C462	ECA1HM4R7B	CAP,E 4.7UF-50V
C502	ECJ2VC1H471J	CAP,C 470PF-J-50V
C503	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C504	ECJ2VF1H104Z	CAP,C .1UF-Z-50V

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C510	ECCR2H100D5	CAP,C 10PF-D-500V
C511	ECKR2H821KB5	CAP,C 820PF-K-500V
C512	ECKR2H101KB5	CAP,C 100UF-K-500V
C531	**ECA1HM220B**	**CAP,E 22UF-50V**
C551	**ECA1VM331B**	**CAP,E 330UF-35V**
C554	ECKR2H561KB5	CAP,C 560PF-K-500V
C555	**ECA2EM220E**	**CAP,E 22UF-250V**
C556	**ECA1CM471B**	**CAP,E 470UF-16V**
C557	ECKR2H222KB5	CAP,C 2200PF-K-500V
C560	ECEA1HN010UB	CAP,E 1UF/50V
C561	ECKR2H561KB5	CAP,C 560PF-K-500V
C563	**ECWH12H822JS**	**CAP,P .0082UF-J-1.2KV** *CT-2006SE CT-20D11DE CT-2016SE CT-20D11E*
C563	**ECWH12H912JS**	**CAP,P 9100PF-J-1.2KV** *CT-20R6CE CT-20G6E CT-20G6DE CT-20R6E*
C564	ECKW3D561JBR	CAP,C 560PF-J-2KV *CT-20G6E CT-20G6DE CT-20R6E CT-20R6CE*
C564	ECKW3D681JBR	CAP,C 680PF-J-2KV CT-2006SE CT-2016SE CT-20D11E CT-20D11DE
C566	**ECKW3D181JBP**	**CAP,C 180PF-J-2KV**
C569	**ECWF2394JBB**	**CAP,P .39UF-J-200V**
C570	ECA1CM222E	CAP,E 2200UF-16V
C571	ECA1HM220B	CAP,E 22UF-50V
C572	ECA1HM100B	CAP,E 10UF/50V
C573	ECA1CM101B	CAP,E 100UF/16V
C575	ECA0JM222B	CAP,E 2200UF-6.3V
C577	ECA1CM101B	CAP,E 100UF/16V
C578	ECA0JM332B	CAP,E 3300PF-6.3V
C605	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C606	ECA0JM221B	CAP,E 220UF-6.3V
C801	ECKWAE472ZED	CAP,C 4700PF-Z-500V
C802	ECKWAE472ZED	CAP,C 4700PF-Z-500V
C803	ECKWAE472ZED	CAP,C 4700PF-Z-500V
C805	**EC0S2DA221BB**	**CAP,E 220UF/200V**
C806	ECQM4103KZW	CAP,P .01UF-K-400V
C807	ECKR3A821KBP	CAP,C 820PF-K-1KV

REF NO.	PART NO.	DESCRIPTION
C808	ECA1VM101B	CAP,E 100UF-35V
C809	ECKR1H101KB5	CAP,C 100PF-K-50V
C810	ECKR1H471KB5	CAP,C 470PF-K-50V
C812	**ECQU2A224MVA**	**CAP,P .22UF-M-250VAC**
C813	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C814	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C820	ECA1CM101B	CAP,E 100UF/16V
C821	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C822	ECKR3A221KBP	CAP,C 220PF-K-1KV
C823	**ECA1HM471B**	**CAP,E 470UF-50V**
C824	ECKR3A471KBP	CAP,C 470PF-K-1KV
C825	**EEUMG2C221S**	**CAP,E 220UF-160V**
C826	ECKR3A471KBP	CAP,C 470PF-K-1KV
C827	ECA1CM221B	CAP,E 220UF-16V
C828	**ECA160V33UE**	**CAP,E 33UF/160V**
C2201	ECA1HM4R7B	CAP,E 4.7UF-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2202	ECA1HM2R2B	CAP,E 2.2UF-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2203	ECA1HM4R7B	CAP,E 4.7UF-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2204	AP106K016CAE	CAP,T 10UF/16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2205	ECA1HMR33B	CAP,E .33UF-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2206	ECQB1H223JM3	CAP,P .022UF-J-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2207	AP335K016CAE	CAP,T 3.3UF/16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2208	ECJ2VB1C104K	CAP,C .1UF-K-16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C2209	ECJ2VB1C104K	CAP,C .1UF-K-16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2210	ECJ2VB1C104K	CAP,C .1UF-K-16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2212	ECQB1H473JM3	CAP,P .047UF-J-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2213	ECA1HMR47B	CAP,E .47UF-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2214	ECA1CM101B	CAP,E 100UF/16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2215	EEANA1E100B	CAP,E 10UF-25V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2216	ECJ2VC1H100D	CAP,C 10PF-D-50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2301	ECA1VM102E	CAP,E 1000UF-35V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2302	ECEA1HN010UB	CAP,E 1UF/50V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2303	ECA1EM101B	CAP,E 100UF-25V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2304	ECA1EM100B	CAP,E 10UF-25V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2307	ECA1CM102B	CAP,E 1000UF/16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2309	ECA1HM010B	CAP,E 1UF-50V *CT-20D11CT-20D11DE*
C2311	ECA1VM102E	CAP,E 1000UF-35V
C2312	ECEA1HN010UB	CAP,E 1UF/50V
C2313	ECA1EM101B	CAP,E 100UF-25V
C2314	ECA1CM100B	CAP,E 10UF-16V
C2315	ECA1HM010B	CAP,E 1UF-50V *CT-20R6E CT-20R6CE*
C2317	ECA1CM102B	CAP,E 1000UF/16V
C2319	ECA1HM010B	CAP,E 1UF-50V *CT-20D11CT-20D11DE*
C2320	ECA1CM100B	CAP,E 10UF-16V *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
C2321	ECA1CM100B	CAP,E 10UF-16V *CT-20R6E CT-20R6CE*
C2330	ECA1CM100B	CAP,E 10UF-16V
C2350	ECA1HM4R7B	CAP,E 4.7UF-50V
C3001	ECA1HM0R1B	CAP,E 0.1UF/50V
C3012	ECA1HM010B	CAP,E 1UF-50V *CT-20G6E CT-20G6DE CT-2006SECT-2016SE CT-20D11E CT-20D11DE*
C3018	ECA1HM010B	CAP,E 1UF-50V *CT-20G6E CT-20G6DE CT-2006SECT-2016SE CT-20D11E CT-20D11DE*
C3050	ECJ2VF1H103Z	CAP,C .01UF-Z-50V *CT-20D11E CT-20D11DE*
C3051	ECJ2VF1H103Z	CAP,C .01UF-Z-50V *CT-20D11E CT-20D11DE*
DIODES		
D002	MA165TA5VT	DIODE, SWITCHING
D006	MA4330HTA	DIODE
D052	MA4068MTA	DIODE, ZENER
D451	ERA15-01V3	DIODE, RECTIFIER
D452	MA4047MTA	DIODE
D453	MA165TA5VT	DIODE, SWITCHING
D454	MA165TA5VT	DIODE, SWITCHING
D456	MA4047MTA	DIODE
D502	MA4047MTA	DIODE
D531	**AS01V0**	**DIODE**
D551	**D1NL20UV70**	**DIODE**
D554	**AU02V0**	**DIODE**
D561	**AU02V0**	**DIODE**
D571	MA165TA5VT	DIODE, SWITCHING
D606	MA165TA5VT	DIODE, SWITCHING

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
D607	MA152KTX	DIODE *CT-20G6DE CT-2016SE*
D607	MA165TA5VT	DIODE, SWITCHING *CT-20G6E CT-20G6DE CT-2006S ECT-2016SE CT-20D11E CT-20D11DE*
D608	MA152KTX	DIODE *CT-20G6DE CT-2016SE*
D608	MA165TA5VT	DIODE, SWITCHING *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
D609	MA152KTX	DIODE *CT-20G6DE CT-2016SE*
D609	MA165TA5VT	DIODE, SWITCHING *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
D801	**D3SBA60-4103**	**DIODE**
D806	**TAP2AA0001**	**DIODE (THERMISTOR)**
D808	SARS01V1	DIODE
D809	AG01V0	DIODE
D810	AG01V0	DIODE
D811	AG01V0	DIODE
D812	**MA4068MTA**	**DIODE, ZENER**
D820	MA165TA5VT	DIODE, SWITCHING
D821	MA4047HTA	DIODE
D822	RN1ZLF-B1	DIODE
D823	**S3L60P154004**	**DIODE**
D824	D1NL20UV70	DIODE
D2305	MA3110MTX	DIODE, ZENER *CT-20D11E CT-20D11DE*
D2306	MA3110MTX	DIODE, ZENER *CT-20D11E CT-20D11DE*
D2307	MA3110MTX	DIODE, ZENER *CT-20D11E CT-20D11DE*
D2308	MA3110MTX	DIODE, ZENER *CT-20D11E CT-20D11DE*
D2350	MA4068MTA	DIODE, ZENER
D2351	MA165TA5VT	DIODE, SWITCHING
D2352	MA165TA5VT	DIODE, SWITCHING *CT-20G6DE CT-2016SE*
D2353	MA165TA5VT	DIODE, SWITCHING
D2354	MA4091MTA	DIODE *CT-20G6DE CT-2016SE*
D3001	MA3110MTX	DIODE, ZENER
D3003	MA3110MTX	DIODE, ZENER
D3004	MA3110MTX	DIODE, ZENER
D3005	MA3110MTX	DIODE, ZENER *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
D3006	MA3110MTX	DIODE, ZENER *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
D3017	MA3110MTX	DIODE, ZENER
D3018	MA3110MTX	DIODE, ZENER
D3019	MA3110MTX	DIODE, ZENER
D3020	MA3110MTX	DIODE, ZENER
D3021	MA3110MTX	DIODE, ZENER
D3022	MA3110MTX	DIODE, ZENER
	FUSES	
F801	**XBA2A00101**	**FUSE 6.3A 125V**
	INTEGRATED CIRCUITS	
IC001	**M65580MAP101**	**MPU/VCJ**
IC002	TVR2AJ087	EEPROM *CT-20R6E CT-20R6CE*
IC002	TVR2AJ086	EEPROM *CT-20G6E CT-20G6DE CT-20D11E CT-20D11DE CT-2006SE CT-2016SE*
IC003	PIC-37042SR	REMOTE SENSOR
IC005	PQ1R33	3.3 V REGULATOR
IC006	MN1280R	RESET
IC050	TC74HC4066AL	HALF TONE (OSD)
IC451	**LA7837-TV**	**V. OUT**
IC551	AN78L09	9V REGULATOR *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
IC551	AN78M09LB	9V REGULATOR *CT-20R6E CT-20R6CE*
IC552	**AN78M05LB**	**5V REGULATOR**
IC553	**AN78M05LB**	**5V REG. (STAND-BY)**
IC801	**STRG5623**	**VCO (POWER SUPPLY)**

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
IC2201	AN5829S-E1V	MTS , S-AGC *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
IC2301	AN17800A	AUDIO OUT AMP *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE*
IC2301	AN17801A	AUDIO OUT AMP *CT-20D11E CT-20D11DE*
IC2302	AN17800A	AUDIO OUT AMP *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
IC2302	AN17801A	AUDIO OUT AMP *CT-20D11E CT-20D11DE*
	COILS	
J332	TLUABTA150K	COIL, PEAKING 15UH *CT-20G6E CT-20G6DE CT-20R6E CT-20R6CE CT-20D11E CT-20D11DE*
LC005	EXCEMT332DT	EMI FILTER
LC007	EXCEMT332DT	EMI FILTER
LC013	EXCEMT332DT	EMI FILTER
LC018	EXCEMT332DT	EMI FILTER
L001	EXCELSA35T	FERRITE BEAD
L002	EXCELDR35V	FERRITE BEAD
L003	TLUABTA2R2K	COIL, PEAKING 2.2UH
L004	TLUABTA2R2K	COIL, PEAKING 2.2UH
L005	EXCELSA24T	FERRITE BEAD *CT-20D11DE*
L006	EXCELSA24T	FERRITE BEAD
L007	EXCELSA24T	FERRITE BEAD *CT-20D11DE*
L008	TLUABTA470K	COIL, PEAKING 47UH
L009	EXCELSA35V	FERRITE BEAD
L010	ELESN330JA	COIL, PEAKING 33UH
L011	ELESN330JA	COIL, PEAKING 33UH
L013	EXCELSA35V	FERRITE BEAD *CT-20D11DE*
L014	ELESN180KA	COIL, PEAKING 18UH
L015	EXCELSA35T	FERRITE BEAD
L016	EXCELSA35V	FERRITE BEAD
L017	TLUABTA100K	COIL, PEAKING 10UH
L018	TLUABTA150K	COIL, PEAKING 15UH
L090	EXCELSA24T	FERRITE BEAD
L108	EXCELSA35V	FERRITE BEAD
L306	TLUABTA2R2K	COIL, PEAKING 2.2UH
L403	TLUABTA2R2K	COIL, PEAKING 2.2UH
L551	**ELH5L4101**	**COIL**
L801	**ELF15N013A**	**LINE FILTER**
L802	ELEIN680KA	COIL, PEAKING 4.7UH
L803	ELESN120JA	COIL, PEAKING 68UH *CT-20G6DE CT-2016SE*
L803	EXCELSA35V	FERRITE BEAD *CT-20G6E CT-20R6E CT-20R6CE CT-2006SE CT-20D11E CT-20D11DE*
L805	EXCELSA35V	FERRITE BEAD *CT-20G6DE CT-2016SE*
L2350	ELESN4R7JA	COIL, PEAKING 4.7UH *CT-20G6DE CT-2016SE*
L2350	TLTABT4R7K	COIL, PEAKING 4.7UH *CT-20G6E CT-20R6E CT-20R6CE CT-2006SE CT-20D11E CT-20D11DE*
	TRANSISTORS	
Q001	2SD601ARTX	TRANSISTOR
Q006	2SB709ARTX	TRANSISTOR
Q007	2SB709ARTX	TRANSISTOR
Q008	2SB709ARTX	TRANSISTOR
Q009	2SC1473A	TRANSISTOR
Q050	2SB709ARTX	TRANSISTOR
Q051	2SB709ARTX	TRANSISTOR
Q052	2SB709ARTX	TRANSISTOR
Q053	2SD601ARTX	TRANSISTOR
Q054	2SD601ARTX	TRANSISTOR
Q055	2SD601ARTX	TRANSISTOR
Q090	2SB709ARTX	TRANSISTOR
Q092	2SB709ARTX	TRANSISTOR
Q351	2SC3063RL	TRANSISTOR
Q352	2SC3063RL	TRANSISTOR
Q353	2SC3063RL	TRANSISTOR
Q354	2SD601ARTX	TRANSISTOR
Q355	2SD601ARTX	TRANSISTOR

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
Q356	2SD601ARTX	TRANSISTOR
Q451	2SD601ARTX	TRANSISTOR
Q452	2SD601ARTX	TRANSISTOR
Q453	2SD601ARTX	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q505	2SD601ARTX	TRANSISTOR
Q520	2SD601ARTX	TRANSISTOR
Q551	**2SD2499LBMA2**	**TRANSISTOR**
Q605	2SB709ARTX	TRANSISTOR
Q606	2SD601ARTX	TRANSISTOR
Q820	2SA1767QTA	TRANSISTOR
Q830	2SB1011QRL	TRANSISTOR
Q2350	2SB709ARTX	TRANSISTOR
RELAYS		
RL801	**TSEH0005**	**RELAY**
RESISTORS		
R001	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R003	ERJ6GEYJ105V	RES,M 1M-J-1/10W
R004	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R005	ERJ6GEY0R00V	CHIP JUMPER
R006	ERDS2TJ101T	RES,C 100-J-1/4W
R007	ERJ6GEYJ471V	RES,M 470-J-1/10W
R008	ERJ6GEYJ471V	RES,M 470-J-1/10W
R009	ERJ6GEYJ472V	RES,M 12K-J-1/10W
R010	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R011	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R012	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R013	ERJ6GEYJ202V	RES,M 2K-J-1/10W
R014	ERJ6GEYJ221V	RES,M 220-J-1/10W
R015	ERJ6GEYJ221V	RES,M 220-J-1/10W
R016	ERJ6GEYJ221V	RES,M 220-J-1/10W
R017	ERJ6GEYJ681V	RES,M 680-J-1/10W
R018	ERJ6GEYJ681V	RES,M 680-J-1/10W
R019	ERJ6GEYJ681V	RES,M 680-J-1/10W
R021	ERJ6GEYJ101V	RES,M 100-J-1/10W
R022	ERJ6GEYJ101V	RES,M 100-J-1/10W

REF NO.	PART NO.	DESCRIPTION
R023	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R024	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R028	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R029	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R032	ERJ6ENF1002V	RES,M 10K-F-1/10W
R033	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R034	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R035	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R036	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R037	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R038	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R039	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R040	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R041	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R042	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R043	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R044	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W *CT-20D11E CT-20D11DE*
R044	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W CT-20G6E CT-20G6DE CT-2006SE CT-2016SE
R045	ERJ6GEYJ101V	RES,M 100-J-1/10W
R046	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R062	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R063	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R064	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R065	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R066	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R067	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R068	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R069	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W *CT-20D11E* *CT-20G6E CT-20G6DE* *CT-20R6E CT-20R6CE* *CT-2006SE CT-2016SE*
R070	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R071	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R072	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R077	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20D11E CT-20D11DE*

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R078	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R079	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20R6E CT-20R6CE*
R081	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R090	ERJ6GEYJ471V	RES,M 470-J-1/10W
R091	ERJ6GEYJ185V	RES,M 1.8MEG-J-1/10W
R092	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R093	ERJ6GEYJ331V	RES,M 330-J-1/10W
R201	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W *CT-20G6E CT-20G6DE CT-2016SE CT-20D11E CT-20D11DE*
R201	ERJ7GEYJ182V	RES,M 75.0-F-1/8W *CT-2006SE*
R202	ERJ6GEYJ102V	RES,M 1K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R353	ERG2FJ123H	RES,M 12K-J-2W
R354	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R355	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R356	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R357	ERJ6ENF5100V	RES,M 510-F-1/10W
R358	ERJ6ENF5100V	RES,M 510-F-1/10W
R359	ERJ6ENF5100V	RES,M 510-F-1/10W
R360	ERJ6ENF5100V	RES,M 510-F-1/10W
R361	ERJ6ENF5100V	RES,M 510-F-1/10W
R362	ERJ6ENF5100V	RES,M 510-F-1/10W
R363	ERJ6GEYJ101V	RES,M 100-J-1/10W
R364	ERJ6GEYJ101V	RES,M 100-J-1/10W
R365	ERJ6GEYJ101V	RES,M 100-J-1/10W
R381	ERJ6GEYJ101V	RES,M 100-J-1/10W
R382	ERJ6GEYJ101V	RES,M 100-J-1/10W
R383	ERJ6GEYJ101V	RES,M 100-J-1/10W
R384	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R385	ERJ6ENF4421V	RES,M 4.42K-F-1/10W
R386	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R387	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R388	ERJ6ENF4421V	RES,M 4.42K-F-1/10W
R389	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R390	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R391	ERJ6ENF4421V	RES,M 4.42K-F-1/10W
R392	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R439	ERDS2TJ102T	RES,C 1K-J-1/4W
R450	ERJ6GEYJ563V	RES,M 56K-J-1/10W
R451	ERDS1FJ1R2P	RES,C 1.2-J-1/2W
R454	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R455	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R456	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R457	ERJ6GEYJ152V	RES,M 1.5K-J-1/10W
R458	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R459	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R460	ERDS2TJ102T	RES,C 1K-J-1/4W
R462	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R463	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R465	ERJ6GEYJ303V	RES,M 30K-J-1/10W
R467	ERJ6GEYJ183V	RES,M 18K-J-1/10W
R468	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R469	ERJ6GEYJ220V	RES,M 22-J-1/10W
R470	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R471	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R472	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R475	ERJ6GEYJ471V	RES,M 470-J-1/10W
R502	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R504	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R505	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R506	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R507	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R508	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R510	**ERG3FJ272H**	**RES,M 2.7K-J-3W**
R510	**ERG3FJ332H**	**RES,M 3.3K-J-3W** ***CT-20R6E, CT-20R6CE CT-20G6E, CT-20G6DE***
R512	ERG2FJ562H	RES,M 5.6K-J-2W
R520	ERJ6GEYJ471V	RES,M 470-J-1/10W

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R521	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R531	**ERD25FJ470P**	**RES,C 47-J-1/4W**
R532	**ERJ6ENF8871V**	**RES,M 8.87K-F-1/10W** ***CT-20G6E CT-20R6E CT-20R6CE***
R532	**ERJ6ENF1502V**	**RES,M 15K-F-1/10W** ***CT-20D11DE CT-2006SE CT-2016SE CT-20D11E***
R532	**ERJ6ENF8871V**	**RES,M 8870-F-1/10W** ***CT-20G6DE***
R533	**ERJ6ENF1201V**	**RES,M 1.2K-F-1/10W** ***CT-20G6E CT-20G6DE CT-20R6ECT-20R6CE***
R533	**ERJ6ENF1781V**	**RES,M 1.78K-F-1/10W** ***CT-2016SE CT-20D11E CT-20D11DE***
R533	**ERJ7ENF1781V**	**RES,M 75.0-F-1/8W** ***CT-2006SE***
R551	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R552	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R555	**ERDS1FJ101T**	**RES,C 100-J-1/2W**
R556	ERG1SJ221P	RES,M 220-J-1W
R557	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R558	**ERQ2CJP2R2S**	**RES,F 2.2-J-2W** ***CT-20G6DE CT-20G6E CT-20R6E CT-20R6CE***
R558	**ERQ2CJP2R2S**	**RES,F 2.2-J-2W** ***CT-20D11DE CT-2006SE CT-2016SE CT-20D11E***
R559	ERG2FJ683H	RES,M 12K-J-2W
R562	ERG3FJ680H	RES,M 68-J-3W
R563	ERG1SJ150P	RES,M 15-J-1W
R567	ERG2FJ122H	RES,M 12K-J-2W
R572	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R605	ERDS2TJ103T	RES,C 10K-J-1/4W
R606	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R607	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R608	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R802	ERDS2TJ684T	RES,C 680K-J-1/4W
R803	ERG2FJ100H	RES,M 10K-J-1/2W
R804	ERG2FJ104H	RES,M 100K-J-2W

REF NO.	PART NO.	DESCRIPTION
R805	**ERX2FJR18H**	**RES,M .18-J-2W** **CT-20G6E CT-20R6E CT-20R6CE CT-2006SE CT-20D11E CT-20D11DE**
R805	**ERX2FZJR18H**	**RES,M .18-J-2W** ***CT-20G6DE CT-2016SE***
R806	**ERX2FJR56H**	**RES,M .56-J-2W**
R807	ERDS2TJ681T	RES,C 680-J-1/4W
R808	ERDS2TJ4R7T	RES,C 4.7-J-1/4W
R809	ERDS2TJ472T	RES,C 4.7K-J-1/4
R815	**ERC12ZGM825D**	**RES,S 8.2MEG-M-1/2**
R817	**ERX3FJ6R8**	**RES,M 6.8-J-1W**
R821	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R822	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R823	ERDS1FJ272T	RES,C 2.7K-J-1/2W
R824	ERDS2TJ223T	RES,C 22K-J-1/4W
R825	ERDS2TJ272T	RES,C 2.7K-J-1/4W
R828	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R830	ERDS2TJ104T	RES,C 100K-J-1/4W
R831	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R850	**ERQ12HJR56P**	**RES,F .56-J-1/2W**
R2201	ERJ6GEYJ224V	RES,M 220K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2203	ERJ6GEYJ102V	RES,M 1K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2204	ERJ6GEYJ102V	RES,M 1K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2205	ERJ6GEYJ101V	RES,M 100-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2206	ERJ6GEYJ273V	RES,M 27K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2301	ERQ2CJP3R9S	RES,F 3.9-J-2W
R2307	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2320	ERJ6GEYJ104V	RES,M 100K-J-1/10W *CT-20D11E CT-20D11DE*

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R2325	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20R6E CT-20R6CE*
R2350	ERDS2TJ102T	RES,C 3.9K-J-1/4W *CT-20R6E CT-20R6CE*
R2350	ERDS2TJ391T	RES,C 390-J-1/4W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2351	ERJ6GEYJ273V	RES,M 27K-J-1/10W *CT-20R6E CT-20R6CE*
R2351	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2352	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R2353	ERJ6GEYJ124V	RES,M 120K-J-1/10W
R2354	ERJ6GEYJ123V	RES,M 12K-J-1/10W *CT-20G6DE CT-2016SE*
R2355	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R2355	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W *CT-20G6E*
R2356	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2357	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2360	ERJ6GEYJ681V	RES,M 680-J-1/10W *CT-20R6E CT-20R6CE*
R2361	ERJ6GEYJ221V	RES,M 220-J-1/10W *CT-20R6E CT-20R6CE*
R2362	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20R6E CT-20R6CE*
R2365	ERDS2TJ102T	RES,C 1K-J-1/4W *CT-20G6DE CT-2016SE*
R2370	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2417	ERJ6GEYJ104V	RES,M 100K-J-1/10W *CT-20D11E CT-20D11DE*
R3001	ERDS2TJ101T	RES,C 100-J-1/4W
R3005	ERJ6GEYJ334V	RES,M 330K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R3007	ERDS2TJ151T	RES,C 150-J-1/4W
R3008	ERJ6GEYJ151V	RES,M 75.0-F-1/10W
R3009	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3010	ERJ6GEYJ334V	RES,M 330K-J-1/10W
R3011	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R3013	ERJ6ENF75R0V	RES,M 75.0-F-1/10W *CT-20D11E CT-20D11DE*
R3014	ERJ6ENF75R0V	RES,M 75.0-F-1/10W *CT-20D11E CT-20D11DE*
R3016	ERDS2TJ181T	RES,C 180-J-1/4W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R3017	ERDS2TJ181T	RES,C 180-J-1/4W
R3018	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3019	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W *CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE*
R3050	ERJ6GEYJ101V	RES,M 100-J-1/10W *CT-20D11E CT-20D11DE*
R3051	ERJ6GEYJ101V	RES,M 100-J-1/10W *CT-20D11E CT-20D11DE*
SWITCHES		
S001	EVQPF106K	SWITCH (POWER)
S002	EVQPF106K	SWITCH
S003	EVQPF106K	SWITCH
S004	EVQPF106K	SWITCH
S005	EVQPF106K	SWITCH
S008	EVQPF106K	SWITCH (ACTION)
S009	EVQPF106K	SWITCH
TRANSFORMERS		
T501	TLH15452	TRANSFORMER
T551	**KFT3AA341F**	**TRANSFORMER, FLYBACK**
T801	**ETS29AS183NC**	**TRANSFORMER**
CRYSTALS/FILTERS		
X001	TSSA092	CRYSTAL OSCILLATOR
X002	AF080005BE	CRYSTAL OSCILLATOR
OTHERS		
TNR001	**ENG36604G**	**TUNER** ***CT-20R6E CT-20R6CE***
TNR001	**ENG36610G**	**TUNER** ***CT-20G6E CT-20G6DE CT-2006SE CT-2016SE CT-20D11E CT-20D11DE***

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
M001	EUR501450	REMOTE CONTROL *CT-20R6E CT-20R6CE*
M002	EUR501455	REMOTE CONTROL *CT-20G6E CT-20G6DE* *CT-2006SE CT-2016SE*
M003	EUR511502	REMOTE CONTROL *CT-20D11E CT-20D11DE*
M004	UR50EC1190A	BATTERY COVER, REMOTE *CT-20G6E CT-20G6DE* *CT-20R6E CT-20R6CE* *CT-2006SE CT-2016SE*
M005	UR51EC975A	BATTERY COVER, REMOTE *CT-20D11E CT-20D11DE*
M006	**TSX2AA0111**	**AC LINE CORD** ***CT-20G6E CT-20G6DE*** ***CT-20R6E CT-20R6CE*** ***CT-20D11E CT-20D11DE***
M007	**TSX2AA0281**	**AC LINE CORD** ***CT-2006SE CT-2016SE***
M008	**A51KQN011X**	**CRT 20"** ***CT-2006SE CT-2016SE*** ***CT-20D11E CT-20D11DE***
M009	**A51KRE89XDT**	**CRT 20"** ***CT-20G6E CT-20G6DE*** ***CT-20R6ECT-20R6CE***
M010	**TJSC00300**	**CRT SOCKET**
DY	**TLY2AA001**	**DEFLECTION YOKE** ***CT-20G6E CT-20G6DE*** ***CT-20R6E CT-20R6CE***
DY	**TLY2AA010**	**DEFLECTION YOKE** ***CT-2006SE CT-2016SE*** ***CT-20D11E CT-20D11DE***
M011	TMM2A30702	WEDGE, YOKE
M012	JH291U-009	YOKE, CONVERGENCE *CT-20G6E CT-20G6DE* *CT-20R6E CT-20R6CE*
M013	0FMK014ZZ	CONV. CORRECTOR STRIP
DEG	**TSP2AA008**	**DEGAUSSING COIL**
M014	TXANV03ESER	DEG. COIL INSTALLATION KIT Small plastic ties(2) Large plastic ties(2)
M015	TXF3A011DB2	ASSY. DAG GROUND
M016	TXFKY04ESER	ASSY, CABINET FRONT Panasonic Badge(1), Smoked sheet(1), IR guide(1), Front Cabinet(1), Felt. *CT-2006SE CT-2016SE*
M017	TXFKY06ESER	ASSY, CABINET FRONT Panasonic Badge(1), IRguide(1), Front Cabinet(1) *CT-20G6E CT-20G6DE*
M018	TXFKY07ESER	ASSY, CABINET FRONT Panasonic Badge(1), IRguide(1), Front Cabinet(1) *CT-20D11E CT-20D11DE*
M019	TXFKY09ESER	ASSY, CABINET FRONT Panasonic Badge(1), IRguide(1), Front Cabinet(1) CT-20R6E CT-20R6CE
M020	TBX2AA00301G	BUTTON, 7-KEY *CT-2006SE CT-2016SE*
M021	TBX2AA1701GS	BUTTOM, 7-KEY *CT-20G6E CT-20G6DE* *CT-20R6E CT-20R6CE* *CT-20D11E CT-20D11DE*
M022	TKP2AA00601	SMOKED SHEET *CT-2006SE CT-2016SE*
M023	TKX2AA00401	GUIDE, IR *CT-20G6E CT-20G6DE* *CT-20R6E CT-20R6CE* *CT-20D11E CT-20D11DE*
M024	TKX2A3753	GUIDE, IR *CT-2006SE CT-2016SE*
M025	TAS2AA0012	SPEAKER 16-OHM 1.5W
M026	TBX1886601	PUSHBUTTON, SPEAKER *CT-20D11E CT-20D11DE*
M027	TXFKU05ESER	ASSY, CABINET BACK Double Insulation Label(1), Model nameplate(1), Cabinet Back(1), Fetl, X-Ray label(2) *CT-20G6E CT-20G6DE*
M028	TXFKU06BSER	ASSY, CABINET BACK Double Insulation Label(1), Cabinet Back(1), Felt, X-Ray label(1) *CT-2006SE CT-2016SE*
M029	TXFKU06ESER	ASSY, CABINET BACK Double Insulation Label(1), Model nameplate(1), Cabinet Back(1), X-Ray label(2) *CT-20D11E CT-20D11DE*
M030	TXFKU08ESER	ASSY, CABINET BACK Double Insulation Label(1), Model nameplate(1), Cabinet Back(1), X-Ray label(2) *CT-20R6E CT-20R6CE*
JK3001	TJB2A9061B	BRACKET,A/V *CT-20R6E CT-20R6CE*

REPLACEMENT PARTS LIST

Models: CT-20R6E, CT-20R6CE, CT-2016SE, CT-2006SE, CT-20G6E, CT-20G6DE, CT-20D11E, CRT-20D11DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
JK3001	TJB2A9063B	ASSY. JACK 1A/V *CT-20D11E CT-20D11DE*
JK3001	TJB2A9064B	ASSY. JACK A/V *CT-20G6E CT-20G6DE* *CT-2006S CT-2016SE*
JK3002	TJB2AA0046	TERMINAL, FRONT A/V *CT-20G6E CT-20G6DE* *CT-2006SE CT-2016SE* *CT-20D11E CT-20D11DE*
JK3002	TJB2AA0048	TERMINAL, FRONT A/V *CT-20R6E CT-20R6CE*
JK3003	TJB2AA0171	TERMINAL, S-VHS *CT-20D11E CT-20D11DE*
M031	TQB2AA0388	MANUAL, OWNERS *CT-20G6E* *CT-20R6E CT-2006SE* *CT-2016SE CT-20D11E*
M032	TQB2AA0396	MANUAL, OWNERS *CT-20R6CE* *CT-20G6DE CT-20D11DE*
M033	TQB2AA7057	REMOTE GUIDE *CT-20R6E CT-20R6CE*
M034	TQB2AA7058	REMOTE GUIDE *CT-20D11E CT-20D11DE*
M035	TQB2AA7095	REMOTE GUIDE *CT-20G6E CT-20G6DE* *CT-2006SE CT-2016SE*
M036	TQB2AA7108	V-CHIP MANUAL *CT-20D11DE CT-20D11E* *CT-20G6E CT-20G6DE* *CT-20R6E CT-20R6CE* *CT-2006SE CT-2016SE*

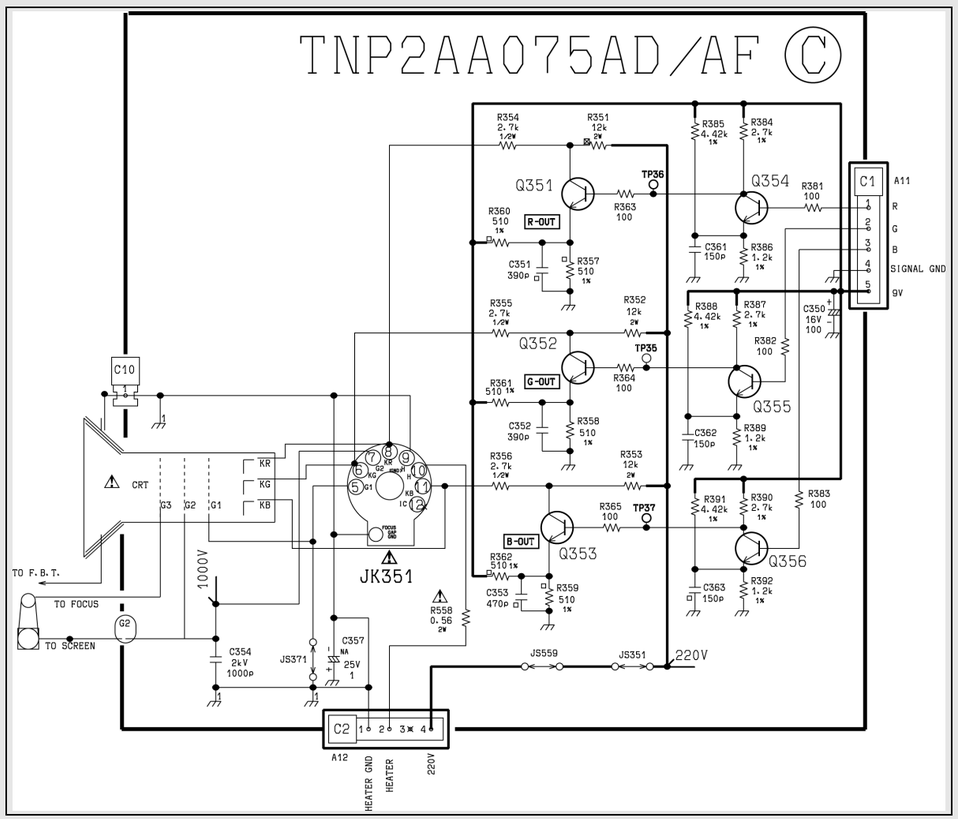
DESCRIPTION OF ABBREVIATIONS GUIDE

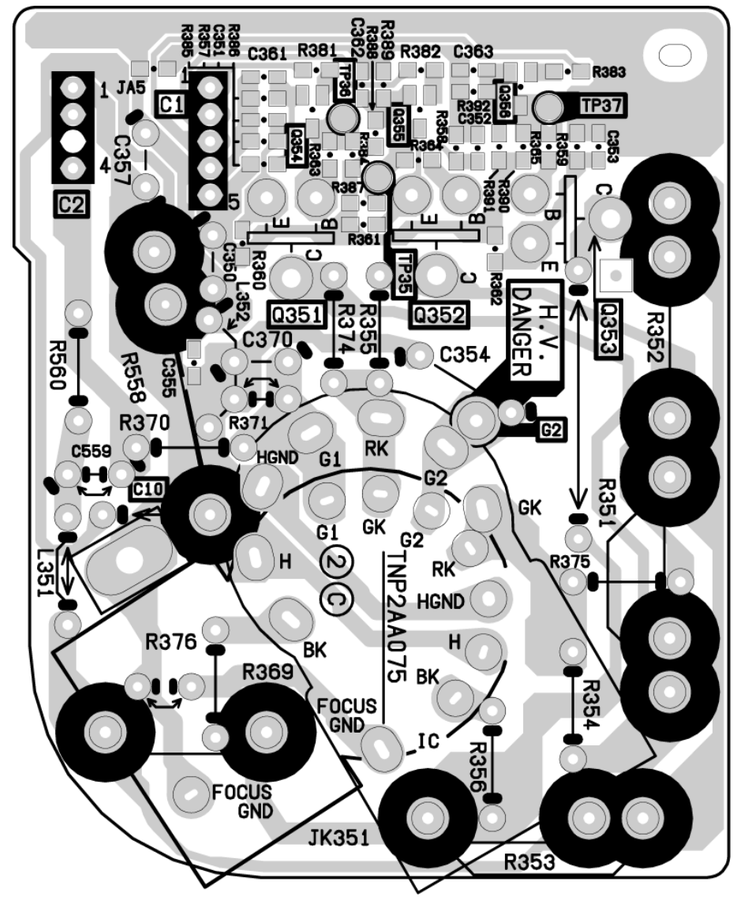
RESISTOR			
TYPE		**TOLERANCE**	
C	Carbon	F	+/- 1%
F	Fuse	J	+/- 5%
M	Metal Oxide	K	+/- 10%
S	Solid	M	+/- 20%
W	Wire Wound	G	+/- 2%

RES, C 270-J-1/4

CAPACITOR			
TYPE		**TOLERANCE**	
C	Ceramic	C	+/- 0.25pF
E	Electrolytic	D	+/- 0.5pF
P	Polyester	F	+/- 1pF
S	Styrol	J	+/- 5%
T	Tantalum	K	+/- 10%
		L	+/- 15%
		M	+/- 20%
		P	+10% -0%
		Z	+80% -20%

CAP, P .068UF-K-50V

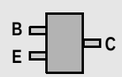




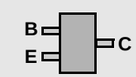
	Q351	Q352	Q353
B	7.47	7.40	7.40
C	96.00	98.20	98.80
E	7.00	6.90	6.90

	Q354	Q355	Q356
B	2.90	2.90	2.90
C	7.50	7.40	7.40
E	2.40	2.40	2.40

CHIP TRANSISTOR LEAD DESIGNATION



IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in µH.
4. Test point indicated by ● Test point but no pin ⟟.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

Note:

Obtained voltages with a digital multimeter.

Nota:

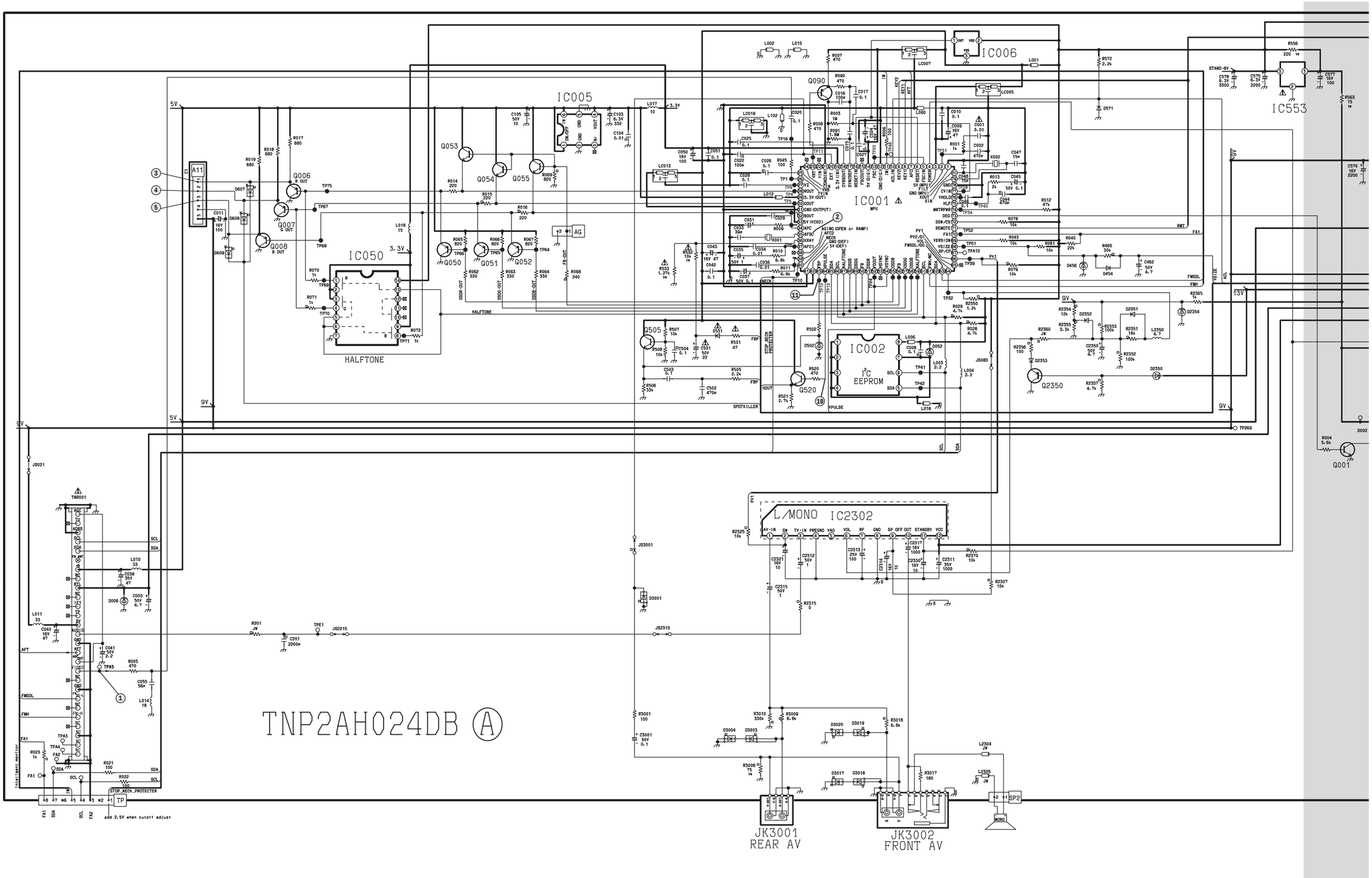
La medición de los voltajes se hizo con un Voltímetro Digital.

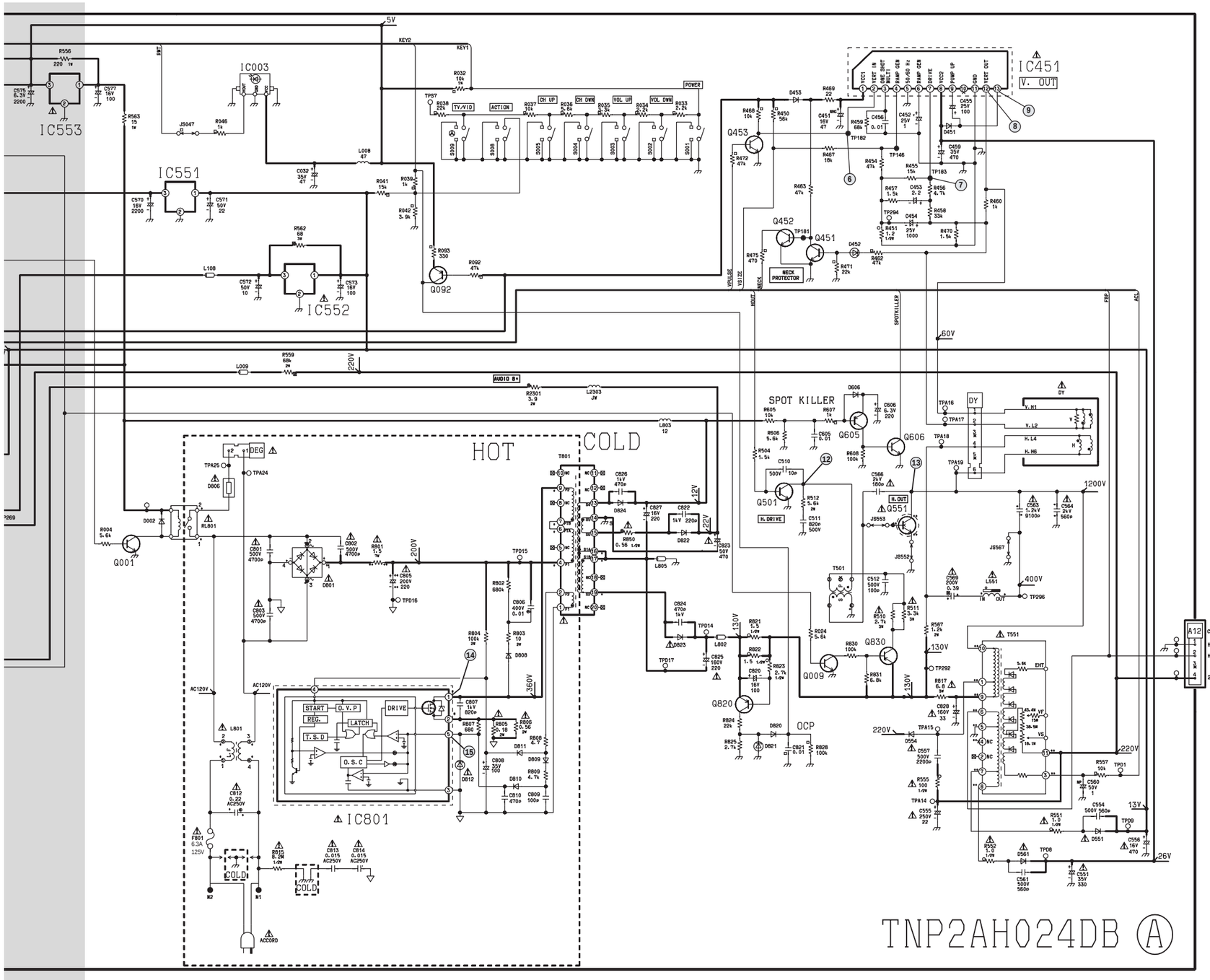
Notas de los Diagramas

1. Las Resistencias son de Carbón de 1/4W, a menos que se indique otra característica.
2. Los Capacitores son de Cerámica para 50V, a menos que se indique otra característica.
3. El valor indicado de las Bobinas es la inductancia expresada en µH.
4. Los puntos de prueba en la terminal de algún componente son indicados por ● Los puntos de prueba fuera de los componentes se indican con ⟟.
5. Los componentes señalados con el símbolo ⚠ son considerados componentes críticos y deben ser reemplazados sólo con las partes especificadas por el fabricante.
6. ▬▬ (**LINEA GRUESA**) indica las líneas de alimentación de los Voltajes B+.
7. Los diagramas eléctricos están sujetos a cambio sin previo aviso.
8. El símbolo ⏚ indica que es una conexión a **Tierra Caliente** y el símbolo ⏚ indica conexión a **Tierra Fría**.

NOTA: Los demas símbolos de componentes incluidos son usados con fines de diseño.

A Board Schematic, Left Portion - Diagrama Eléctrico de la Tarjeta A, Sección Izquierda





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Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   -
     strength and picture
   -
2. Ground symbol
   ground lead connection
   Incorrect ground conne
   result in erroneous readi

CAUTION:
connection of the test equi
result in erroneous readings

NOTA DE SEGURIDAD

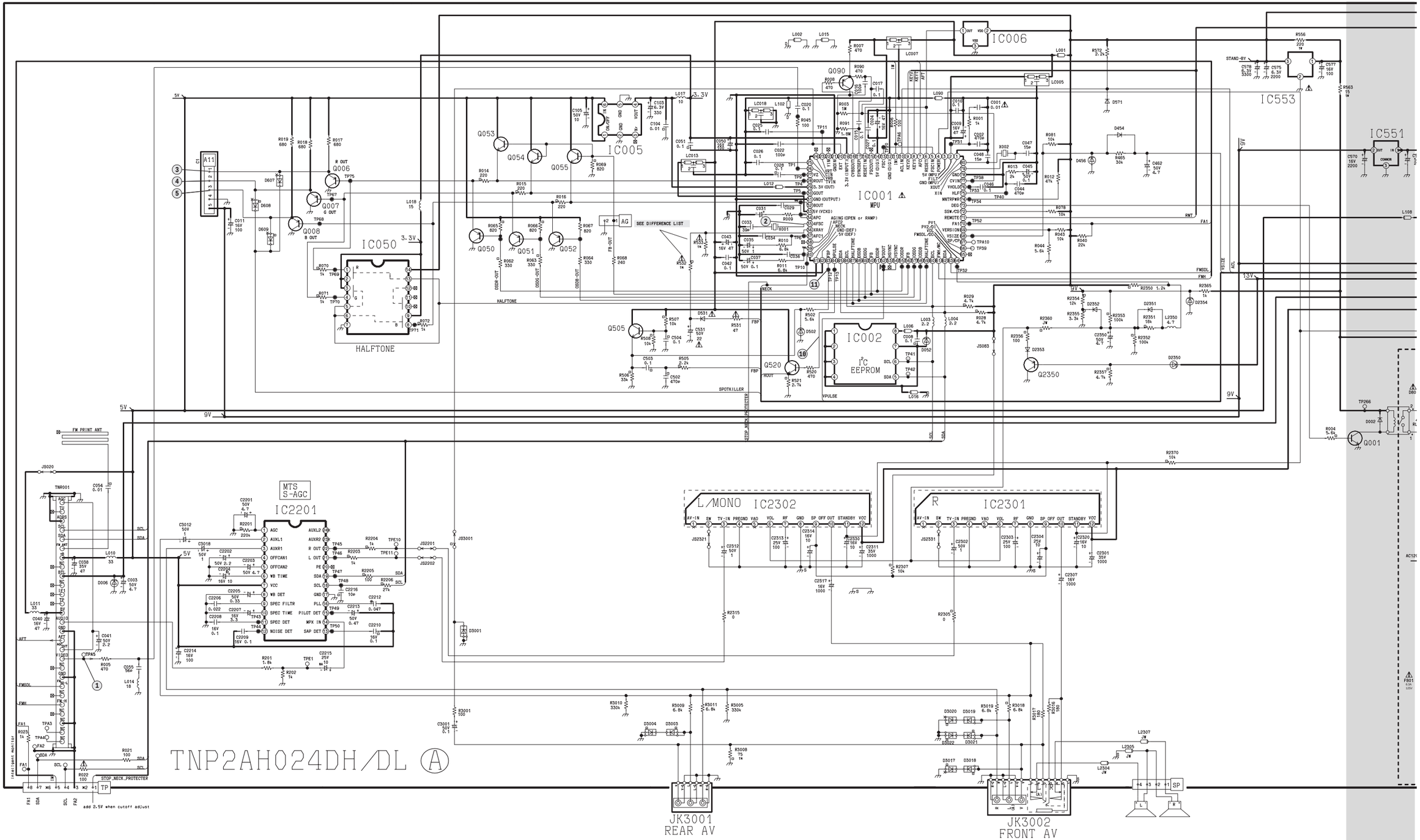
LOS DIAGRAMAS ELÉCTRICOS INCLUYEN CARACTERÍST
ESPECIALES MUY IMPORTANTES PARA LA PROTEC
CONTRA RAYOS-X, QUEMADURAS Y DESCAR
ELÉCTRICAS. CUANDO SE DE SERVICIO ES IMPORTA
USAR PARA REEMPLAZO DE COMPONENTES CRITI
SOLO PARTES ESPECIFICADAS POR EL FABRICANTES.
COMPONENTES CRITICOS ESTAN SEÑALADOS EN
DIAGRAMAS POR EL SIMBOLO .

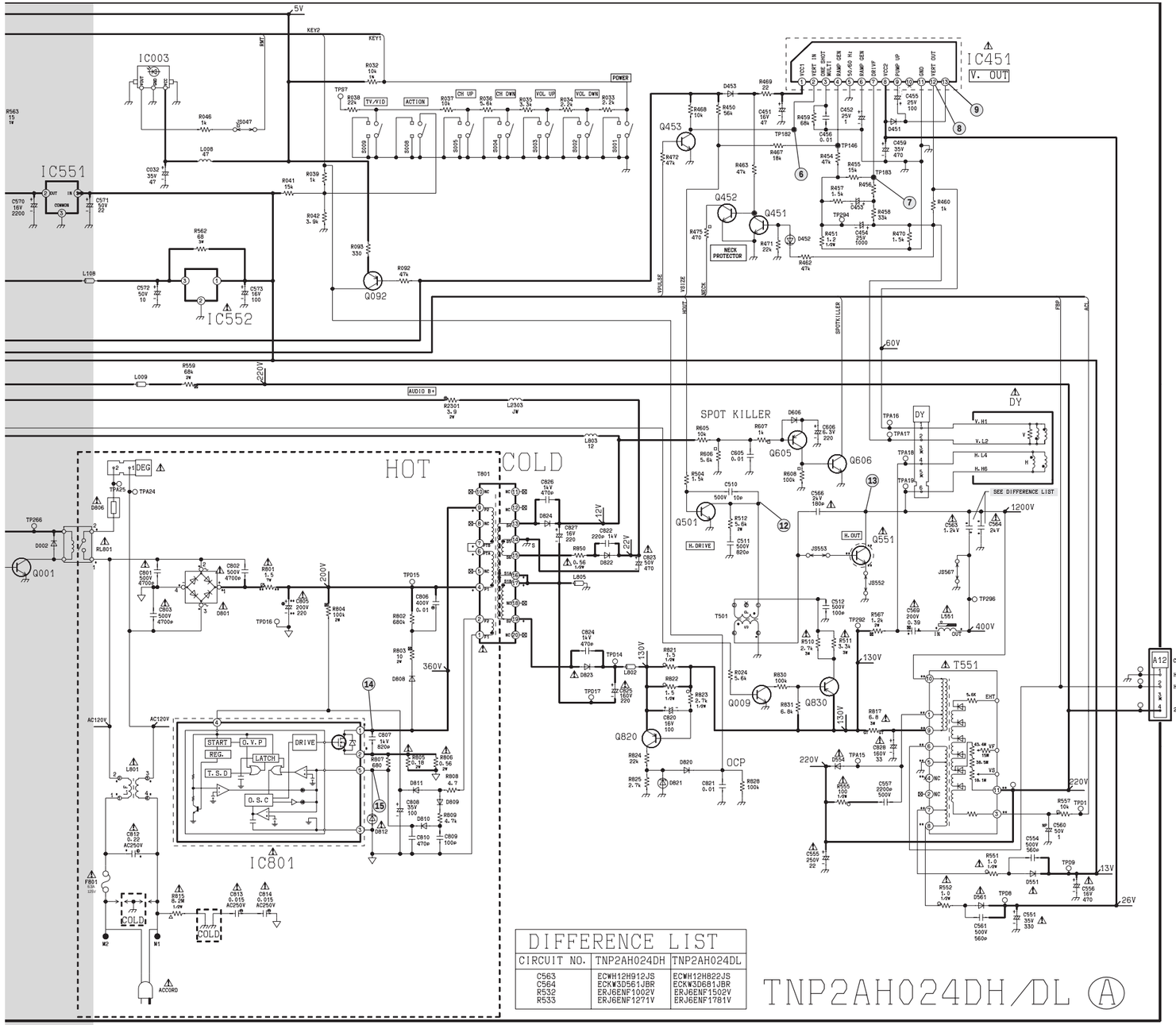
Medición de Voltajes

1. Medición de voltaje:
   - El voltaje de entrada al Receptor es de 120V de Corriente Alterna. Un generador de patrones con formato NTSC se conecta a la entrada de la antena. (Patrón de Barras de Colores con 100 IREs para el Blanco y 7.5 IREs para el Negro.)
   - Los ajustes de los Menus Picture y Audio se normalizan.
     En el Menú Set-Up, en la opción ANTENA, se selecciona el modo de CABLE.
     El nivel de Volumen se minimiza.
     De los modos TV y Video, seleccionar el modo TV.
     Seleccionar modo Estereo del Audio.
   -
     contenido de la image
   -
     nominales.
2.
     medidor.

PRECAUCION:
conexión a la tierra adec
obtendrán mediciones equi
podría dañar el equipo de m

A Board Schematic, Left Portion - Diagrama Eléctrico de la Tarjeta A, Sección Izquierda





DIFFERENCE LIST

CIRCUIT NO.	TNP2AH024DH	TNP2AH024DL
C563	ECWH12H912JS	ECWH12H822JS
C564	ECKW3D561JBR	ECKW3D681JBR
R532	ERJ6ENF1002V	ERJ6ENF1502V
R533	ERJ6ENF1271V	ERJ6ENF1781V

TNP2AH024DH/DL Ⓐ

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CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

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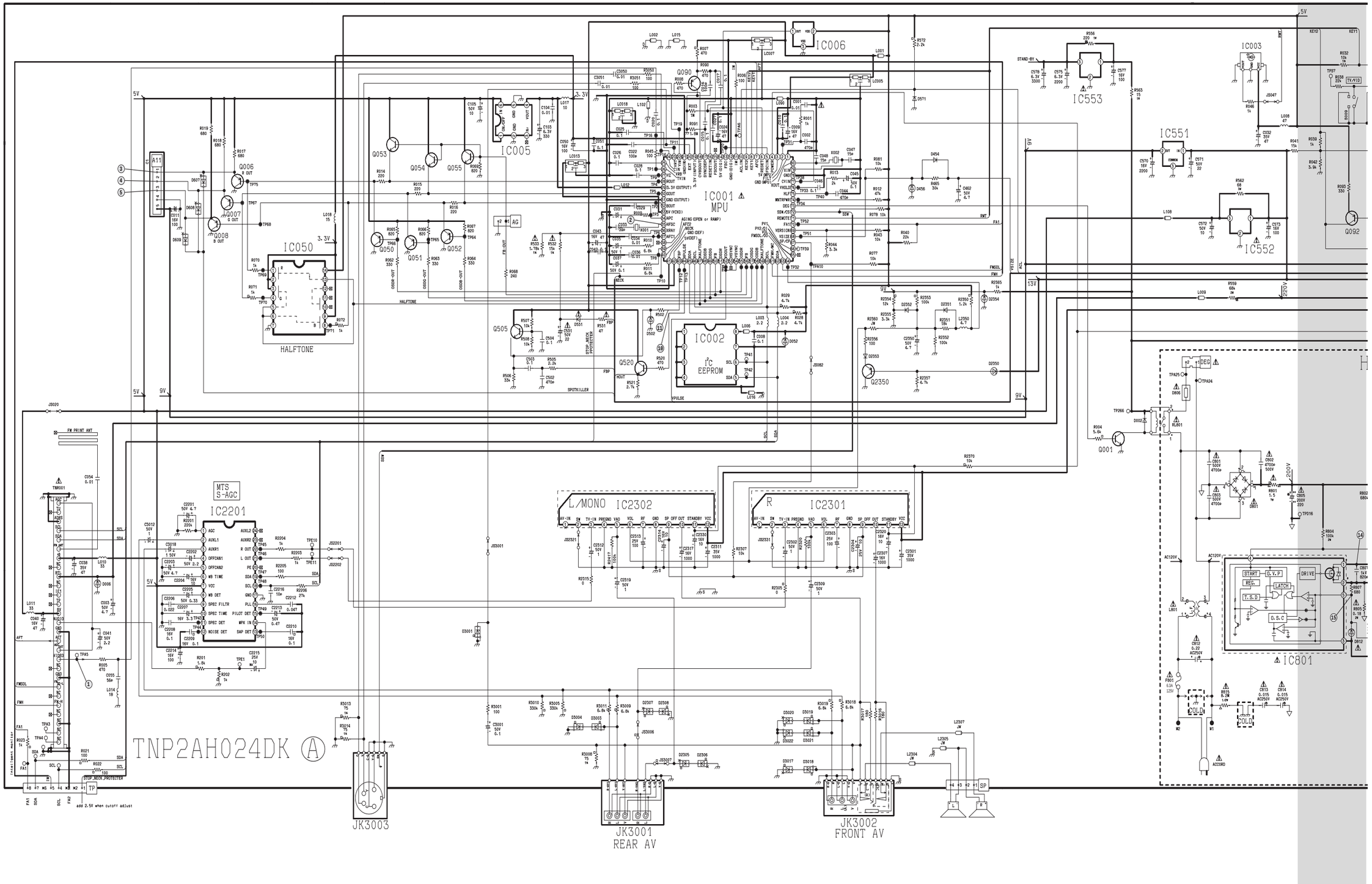
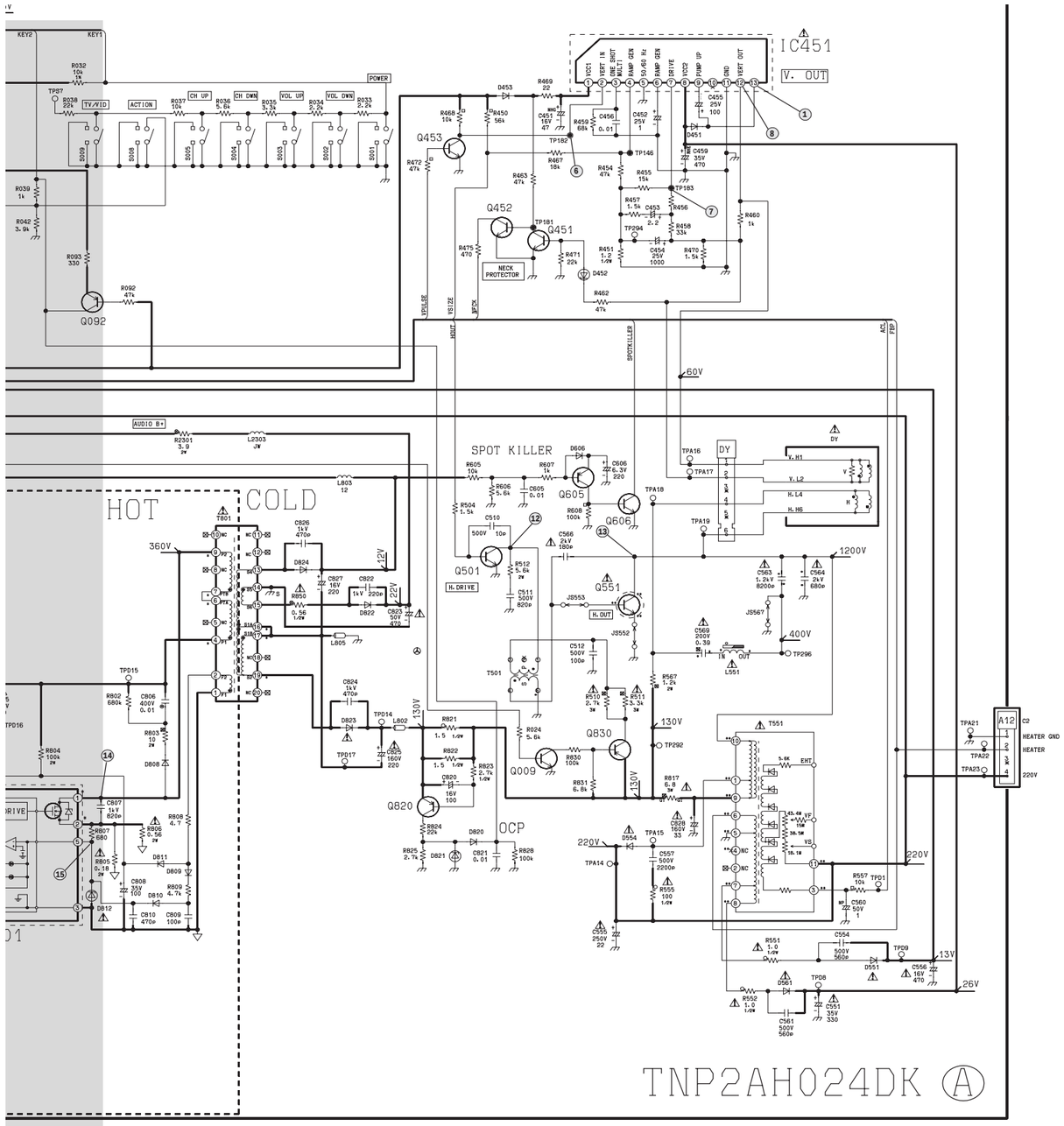
   - Las fuentes de voltajes son nominales.
2. El símbolo ⏚ indica el tipo de tierra que se utiliza en la conexión del medidor.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

A Board Schematic, Left Portion - Diagrama Eléctrico de la Tarjeta A, Sección Izquierda





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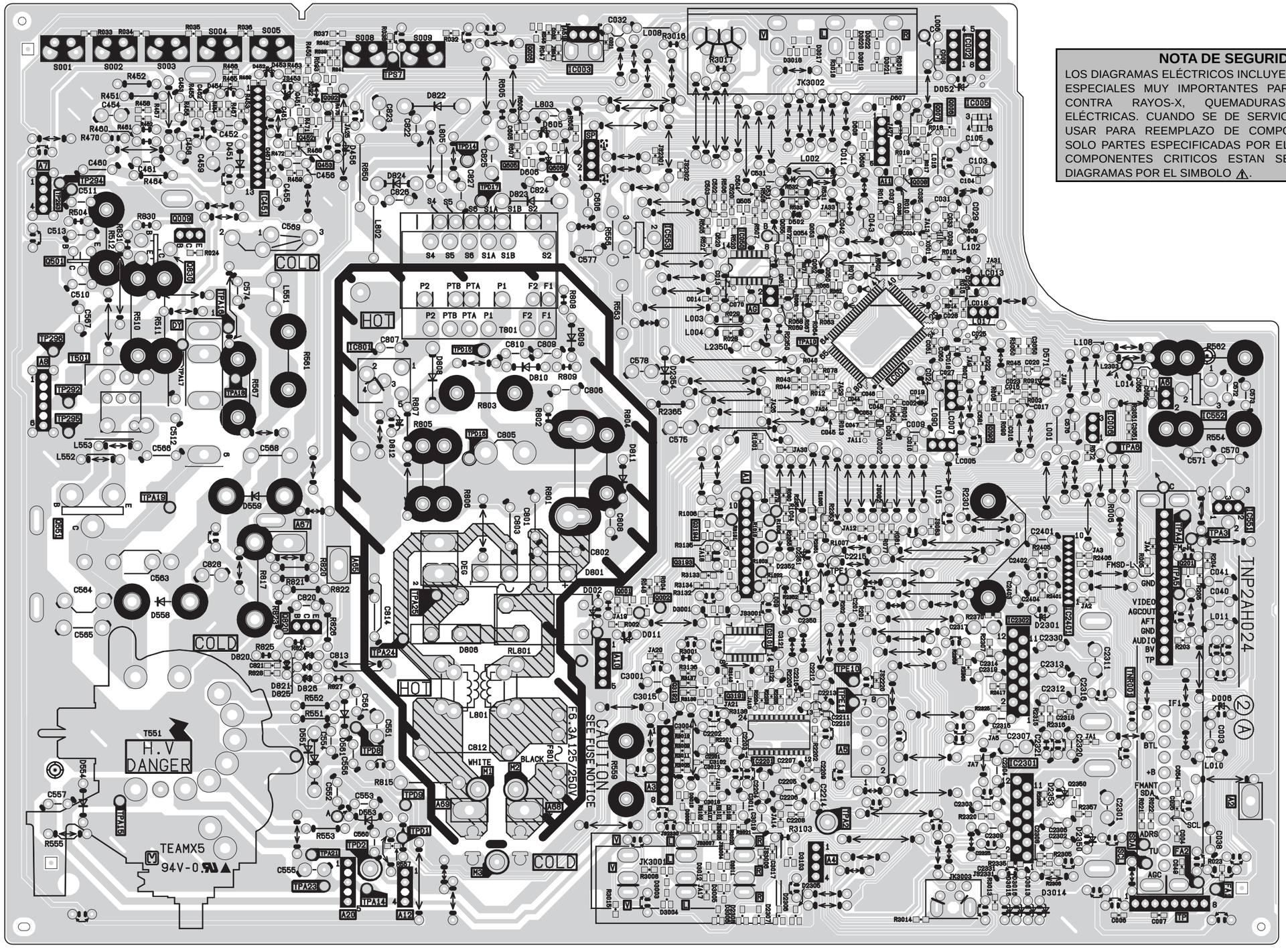


IC001			
1	0.00	41	GND
2	1.39	42	4.97
3	4.98	43	2.32
4	4.91	44	1.76
5	2.47	45	4.46
6	4.95*	46	4.20
7	2.43	47	0.00
8	4.99	48	4.97
9	2.36	49	4.96
10	2.90	50	0.00
11	4.95	51	4.97
12	GND	52	0.17
13	2.47	53	n.c
14	4.97	54	0.17
15	n.c	55	4.97
16	4.98*	56	0.00
17	2.93	57	4.97
18	1.35	58	4.97
19	3.21	59	0.00
20	0.52	60	4.16
21	GND	61	0.00
22	0.62	62	4.45
23	1.69	63	0.00
24	1.09	64	0.39
25	0.45	65	n.c
26	0.95	66	0.00
27	2.06	67	0.00
28	2.59	68	1.94
29	3.26	69	4.98
30	2.69	70	4.98
31	GND	71	4.97
32	2.67	72	4.98
33	4.98	73	0.00
34	2.85	74	4.96
35	2.68	75	1.95
36	2.37	76	0.18
37	2.41	77	2.16
38	3.51	78	0.00
39	n.c	79	2.28
40	2.49	80	2.40

IC002	
1	GND
2	GND
3	GND
4	GND
5	4.40
6	4.16
7	GND
8	4.99

IC003	
1	4.96
2	GND
3	4.98

IC005	
1	5.01
2	GND
3	1.32
4	3.26
5	GND
6	5.01

IC006	
1	5.00*
2	4.98
3	GND

IC050	
1	2.59
2	3.20
3	3.21
4	2.69
5	0.00
6	0.00
7	GND
8	2.67
9	3.21
10	n.c
11	n.c
12	n.c
13	0.00
14	4.99

IC451	
1	8.18
2	8.66
3	4.10
4	4.15
5	GND
6	3.92
7	3.99
8	24.32
9	1.79
10	1.32
11	GND
12	14.01
13	24.67

IC551	
1	12.00
2	GND
3	8.95

IC552	
1	12.01
2	GND
3	5.00

IC553	
1	8.96
2	GND
3	4.99

IC801 ⏚	
1	193.00
2	GND
3	GND
4	32.80
5	2.81

IC2201			
1	1.16	13	3.34
2	2.17	14	2.16
3	2.16	15	3.29
4	2.23	16	3.45
5	2.17	17	GND
6	0.43	18	4.97
7	4.91	19	0.20
8	2.42	20	n.c
9	2.47	21	2.24
10	0.51	22	2.20
11	2.26	23	n.c
12	0.00	24	n.c

IC2301	
1	14.00
2	0.00
3	13.70
4	0.00
5	9.90
6	2.71
7	16.81
8	GND
9	4.98
10	8.80
11	3.41
12	18.81

IC2302	
1	13.58
2	0.00
3	13.62
4	0.00
5	9.88
6	2.69
7	16.65
8	GND
9	4.97
10	8.80
11	3.55
12	18.73

	Q001	Q006	Q007	Q008	Q009
B	0.00	2.59	2.68	2.65	0.59
C	11.00	GND	GND	GND	0.00
E	GND	3.24	3.33	3.31	GND

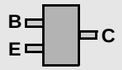
	Q050	Q051	Q052	Q053	Q054
B	4.98	4.97	4.98	0.00	0.00
C	GND	GND	GND	5.00	5.01
E	2.59	2.69	2.67	2.59	2.68

	Q055	Q090	Q092	Q451	Q452
B	0.00	1.31	8.92	0.60	0.00
C	5.01	0.00	2.37	0.00	2.49
E	2.65	2.04	4.99	GND	GND

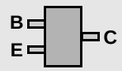
	Q453	Q501	Q505	Q520	Q551
B	0.00	0.36	2.46	1.76	0.00
C	8.66	85.20	4.98	4.98	-25.30
E	GND	0.00	2.32	1.60	GND

	Q605	Q606	Q820	Q830	Q2350
B	4.05	0.00	130.30	129.80	5.22
C	0.00	3.68	0.00	127.78	GND
E	4.01	GND	130.70	130.40	2.70

CHIP TRANSISTOR LEAD DESIGNATION



IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



Nota:

La medición de los voltajes se hizo con un Voltímetro Digital.

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Note:

Obtained voltages with a digital multimeter.

***Note: Set may reset when probing this pin. If TV doesn't Turn ON, unplug from AC outlet, plug it back and turn it ON.**

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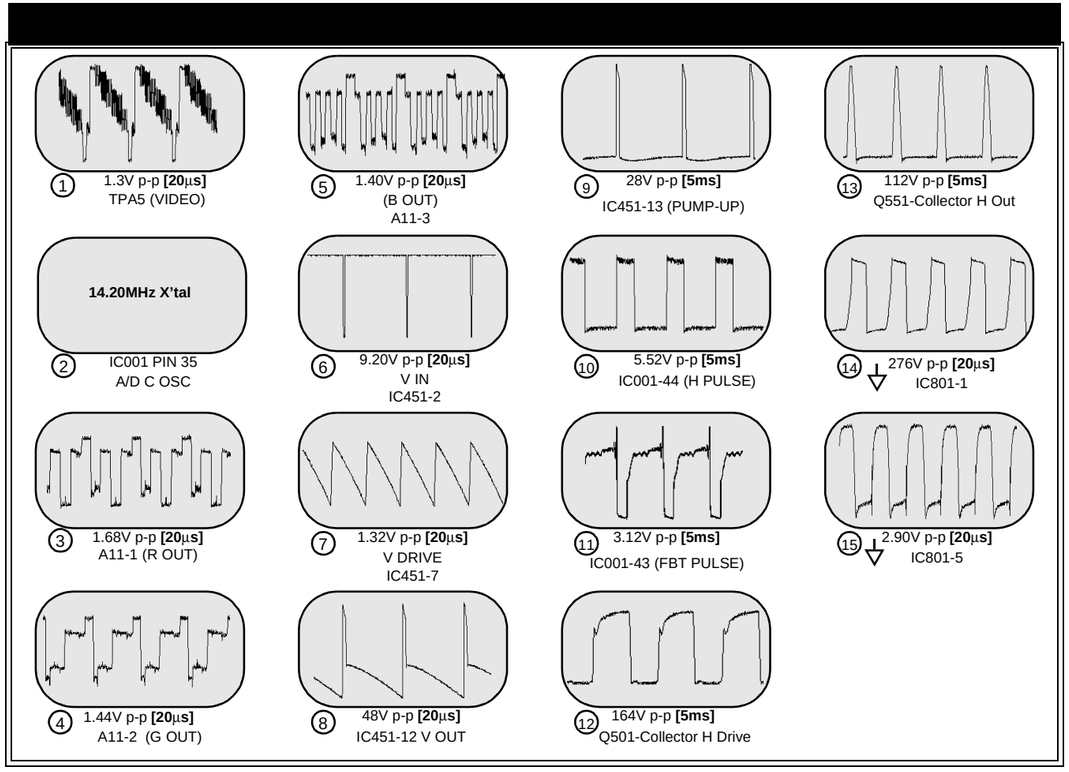
   - Las mediciones de los voltajes son nominales y pueden variar hasta 10% en componentes en funcionamiento. Las lecturas de los voltajes pueden variar por la potencia de la señal y el contenido de la imagen.
   - Las fuentes de voltajes son nominales.
2. El símbolo ⏚ indica el tipo de tierra que se utiliza en la conexión del medidor.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.


1 1.3V p-p [20µs] TPA5 (VIDEO)
5 1.40V p-p [20µs] (B OUT) A11-3
9 28V p-p [5ms] IC451-13 (PUMP-UP)
13 112V p-p [5ms] Q551-Collector H Out
14.20MHz X'tal
2 IC001 PIN 35 A/D C OSC
6 9.20V p-p [20µs] V IN IC451-2
10 5.52V p-p [5ms] IC001-44 (H PULSE)
14 276V p-p [20µs] IC801-1
3 1.68V p-p [20µs] A11-1 (R OUT)
7 1.32V p-p [20µs] V DRIVE IC451-7
11 3.12V p-p [5ms] IC001-43 (FBT PULSE)
15 2.90V p-p [20µs] IC801-5
4 1.44V p-p [20µs] A11-2 (G OUT)
8 48V p-p [20µs] IC451-12 V OUT
12 164V p-p [5ms] Q501-Collector H Drive

NOTA DE SEGURIDAD

LOS DIAGRAMAS ELÉCTRICOS INCLUYEN CARACTERÍSTICAS ESPECIALES MUY IMPORTANTES PARA LA PROTECCIÓN CONTRA RAYOS-X, QUEMADURAS Y DESCARGAS ELÉCTRICAS. CUANDO SE DE SERVICIO ES IMPORTANTE USAR PARA REEMPLAZO DE COMPONENTES CRITICOS, SOLO PARTES ESPECIFICADAS POR EL FABRICANTES. LOS COMPONENTES CRITICOS ESTAN SEÑALADOS EN LOS DIAGRAMAS POR EL SIMBOLO ⚠.

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in µH.
4. Test point indicated by Test point but no pin .
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏚ indicates COLD GROUND.

Note: All other component symbols are used for engineering design purposes.

Medición de Formas de Onda

1. Un símbolo como indica el punto para medir una señal. (La medición puede hacerse en el punto con mayor accesibilidad, siempre que sea común al indicado.)
2. Se midieron utilizando un generador con formato NTSC conectado a la terminal de la antena. (Patrón de 8 Barras de Colores EAI, formato NTSC de 100 IREs para el Blanco y 7.5 IREs para el Negro.)
3. Los ajustes de usuario de los Menus PICTURE y AUDIO se normalizaron. Posteriormente el nivel de volumen se ajusta al mínimo.
4. Las formas de onda de Video y Color fueron tomadas con un osciloscopio de banda alta y con un punta de prueba de baja capacitancia (10 a 1). La forma y amplitud de las ondas puede variar según el tipo de osciloscopio que se utilice y sus características.
5. El símbolo de tierra ⏚ que aparece junto al número de la forma de onda, indica que se utiliza conexión a **Tierra Caliente** en el extremo negativo de la punta de prueba.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Notas de los Diagramas

1. Las Resistencias son de Carbón de 1/4W, a menos que se indique otra característica.
2. Los Capacitores son de Cerámica para 50V, a menos que se indique otra característica.
3. El valor indicado de las Bobinas es la inductancia expresada en µH.
4. Los puntos de prueba en la terminal de algún componente son indicados por Los puntos de prueba fuera de los componentes se indican con .
5. Los componentes señalados con el símbolo ⚠ son considerados componentes críticos y deben ser reemplazados sólo con las partes especificadas por el fabricante.
6. ▬ (**LINEA GRUESA**) indica las líneas de alimentación de los Voltajes B+.
7. Los diagramas eléctricos están sujetos a cambio sin previo aviso.
8. El símbolo ⏚ indica que es una conexión a **Tierra Caliente** y el símbolo ⏚ indica conexión a **Tierra Fría**.

NOTA: Los demas símbolos de componentes incluidos son usados con fines de diseño.

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